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4-29-09—25000.

KANSAS STATE AGRICULTURAL COLLEGE

EXPERIMENT STATION.—CIRCULAR 1.

DEPARTMENT OF ENTOMOLOGY
T. J. HEADLEE, ENTOMOLOGIST AND ZOOLOGIST IN CHARGE.

TREATING SEED-CORN TO PROTECT IT FROM BURROWING ANIMALS

BY

THEO. H. SCHEFFER,
Assistant in Zoölogical Investigation.

At this season of the year a great many inquiries are being received at the Station concerning methods of so treating seed-corn as to prevent its being taken in the ground by moles and other burrowing animals. It is partly to supply timely information on the subject and partly to secure the coöperation of farmers in trying out some of the more promising methods of procedure that this preliminary bulletin is published. It is only fair to state at the outset, however, that plans and methods with us are still following experimental lines, and that no final recommendations can yet be made.

MICE, NOT MOLES, GUILTY.

That the mole is directly responsible for few if any of the numerous and varied depredations laid to his charge, our research the past year has proven conclusively. The mole is a predaceous animal, living chiefly on insects, insect larvæ (particularly white grubs), and earthworms. This conclusion is based on the careful analysis of the stomach contents of over one hundred fifty specimens taken in all months of the year. Three or four species of field mice and the common house mouse habitually frequent the runways which range over the mole's hunting-grounds, and feed on the grains and seeds planted by man and by nature. If one will take the pains to set a few small mouse traps, properly baited, in shallow excavations scooped out in the surface burrows of field and garden, he can do a little detective work on his own account. The excavation containing the trap should be covered by a board or piece of sod.

Experiments in methods of preventing the theft of seed grain in the ground have all followed one of three lines—baiting the pests some days in advance of planting, regular planting of poisoned seed, and surface coating of seed with ill-flavored substances.

Poisoned Bait.—By baiting we mean the introduction of poisoned grain baits into the mole runways through small opening made with a stick. This is the plan that succeeds best with pocket-gophers, for it places the bait where it is sure to be found. The location of the mole's runways is readily indicated by the surface ridging of the earth, especially after a rain. The sharp stick used for making the openings through the roof into the burrow should be no larger than one's finger. Close this opening with a clod after dropping in the kernels of poisoned grain. Either corn or wheat treated with the poisoned syrup used for destroying pocket-gophers will make efficient baits. Ordinary white arsenic may also be used by first wetting the corn with water in which a little gum arabic has been dissolved and then dusting the arsenic over the grain and stirring it thoroughly. If this plan is followed the grain may be allowed to dry before using. The bait may be put out with a hand planter, if the grain has been poisoned by some substance that does not render it sticky. To prepare a bait that will work in a planter, dissolve one-eighth of an ounce of strychnia sulphate in two quarts of hot water, preferably rain water. Soak the corn in this for 48 hours and then spread it out and dry thoroughly.

Poisoned Seed.—A limited number of experiments recently performed seem to indicate that the treatment last mentioned does not in the least injure the germinating powers of the corn, and that seed so treated could be used for the regular planting. We cannot recommend the method, however, until we have given it more thorough test under varying conditions. It is one of our most promising solutions of the problem, and we hope that interested farmers will coöperate with us in making trials of the method on a small scale and report results in detail. Of course, if grain for the regular seeding can be so treated, baiting with poisoned grains will be unnecessary. In testing the method, do not put the corn to soak until the water has cooled and use only so much grain as, after allowing for swelling, will be completely covered by the water; otherwise the kernels that are above water will germinate and the germ will kill on drying.

Coating Seed With Offensive Substances.—The past season we made an extensive series of tests in treating seed-corn with various ill-tasting substances calculated to deter burrowing animals from taking it. The results in most cases were negative—that is, the seed was taken about as readily as though it had not been treated at all. Some of the methods of treatment originated with us, others were recommended. In every case a counted number of kernels of treated corn were put out in not less than twenty different locations and the trial repeated one or more times during the season. All locations were accurately marked and carefully examined at regular intervals. Our notes show that none of the substances used prevented the kernels of corn, or a portion of them, from being eaten or carried off. In most cases the grain was introduced directly into surface runways through an opening made by a lead-pencil or small stick. We had no opportunity to test these substances with crows or spermophiles (striped gophers or ground squirrels). The results of these tests are here briefly summarized:

Substances Which Have Been Found to Injure the Germ of the Seed.

Kerosene, crude petroleum, copperas, crude carbolic acid, fish oil, and spirits of camphor, when used in sufficient quantity or strength to impart an odor to the corn, seriously injure the germinating powers of the grain. To treat the seed with any of these substances in such small quantity or dilute form as not to injure the germ is a waste of time, for the slight taste or odor imparted is soon dissipated in contact with the soil.

Substances not Injurious to the Seed but of no Value or not Available.

Mixing pulverized gum camphor with the dry grain and storing it in a closed vessel for some days has been recommended as an efficient treatment. With us the results were entirely negative. Little or no odor was imparted to the grain. Pine tar was used in our experiments. It has a strong odor, but leaves the grain too sticky to work in a planter.

Substances Which Promise Success and Merit Further Trial.

Coal-tar makes an ideal coating of a rich brown color and a persistent gassy smell. It dries nicely, is not in the least sticky, and will work well in a planter. Wet the grain with a little warm water before stirring in the tar. A teaspoonful of the latter will be sufficient for a peck of corn. The mass must be thoroughly mixed and then dried before attempting to plant. Soaking corn in strong tobacco decoction for a few hours, or simply wetting it with the liquid, seems to promise good results. Of course, the grain must be thoroughly dried before planting. It will have a strong odor and will not be sticky.

REQUEST FOR CO-OPERATION.

Again we express the hope that all who are interested in the matter of treating seed-corn will coöperate with us in making tests under the varying conditions that different localities, different methods, different soils, different animals and differing weather will present. Later we confidently expect to be able to offer more definite and certain recommendations and suggestions.

Approved:
ED. H. WEBSTER,
Director.

Manhattan, Kan., April 28, 1909.

8-12-09—30000

KANSAS STATE AGRICULTURAL COLLEGE

EXPERIMENT STATION.—CIRCULAR 2.

DEPARTMENT OF AGRONOMY
A. M. TENEYCK, AGRONOMIST IN CHARGE.

PREPARING LAND FOR WINTER WHEAT

BY

A. M. TENEYCK,
Professor of Agronomy

L. E. CALL,
Assistant Professor of Soils

PREPARING THE LAND FOR WINTER WHEAT.

With a soil of average fertility, the preparation of the seed-bed by the proper tillage and cultivation methods very largely determines the yield of the crop. Three general methods of tillage for preparing the land for wheat are practiced in this State; namely, plowing, listing, and disking. There may be variations of these three methods, as early plowing, late plowing, shallow plowing, deep plowing, single listing, double listing, little cultivation after plowing, frequent cultivation after plowing, etc. Local conditions may determine which method is the best.

That certain methods are superior to others may be readily shown by comparative trials.

AN EXPERIMENT.

Tests of several methods of preparing the seed-bed for wheat have been carried on at the Experiment Station at Manhattan for the past two seasons and show the following results:

METHOD OF PREPARATION.	Yield per acre, bu.			Cost per acre for prep. 1908-'09	Cost per bu. 1908-'09 Cents......	Value of crop 1908-09 at $1. per bu....	Net profit....
	1907-'08.	1908-'09.	Av. 2 yrs.				
Disked July 15, and at frequent intervals until seeding. Not plowed............	14.95	28.24	21.59	6.88	24.3	28.24	21.36
Double disked July 15. Plowed September 15 seven inches deep................	20.11	30.56	25.33	5.53	18.1	30.56	25.03
Plowed September 15 seven inches deep..	19.59	27.98	23.78	4.66	16.7	27.98	23.32
Plowed September 15 three inches deep..	21.19	30.76	25.97	4.66	15.1	30.76	26.10
Plowed July 15 seven inches deep.........	28.84	35.02	31.93	5.59	15.8	35.02	29.43
Plowed August 15 seven inches deep......	34.74	40.12	37.43	4.53	11.3	40.12	35.59
Plowed August 15 seven inches deep. Not worked until September 15.........	30.53	38.12	34.32	4.03	10.6	38.12	34.09
Listed July 15 seven inches deep and ridges harrowed down..................	20.02	32.17	26.09	4.40	13.6	32.17	27.77
Listed July 15, ridges split August 15, harrowed down	23.67	31.33	27.50	4.65	14.8	31.33	26.88

THE RESULTS EXPLAINED.

The field upon which this experiment was conducted is upland soil, previously seeded to alfalfa. The alfalfa was broken in the fall of 1904, planted to corn in 1905, and sown to wheat in 1906. The experiment was started in 1907 on this wheat stubble. Nine different methods of preparing a seed-bed have been tried, as indicated in the table.

Plowing.—Plowing was done on July 15, August 15, and September 15. It will be seen from the table that the early plowing on July 15 did not give the highest yield or the largest net profit. This was due to the lodging of the wheat on this plot. Being an old alfalfa field, organic matter rich in nitrogen was abundant in this soil. The early and continuous preparation probably produced nitrates in such large amounts that a rank growth of weak straw resulted, and the wheat lodged. With a soil lower in fertility or in a section further west, where less moisture was available, this condition would not usually occur.

The highest yields were obtained from the August 15 plowing. Upon these plots the grain did not lodge. The plot plowed August 15 and cultivated after plowing received two harrowings before September 15. Otherwise it was worked in exactly the same manner as the other August 15 plowed plot, which was not surface cultivated until September 15. These two harrowings in 1907 increased the yield 4 bushels per acre, and in 1908 two bushels per acre, or an additional expense of 50 cents resulted in a profit of $3.00 in 1907 and $1.50 in 1908.

The late plowing, September 15, has each year given the lowest yield of any of the plowed plots, although every effort was taken to prepare a good seed-bed by surface cultivation immediately before seeding. In 1908 the late plowed plots were harrowed three times, disked once and acme-harrowed once after plowing before seeding. The wheat was seeded on all plots October 9. Thus the seeding was not done for nearly a month after plowing; yet the large amount of work put on these late plowed plots was not enough to prepare a sufficiently firm seed-bed. The plot plowed shallow gave a slightly increased yield over the deep plowed plots where each were plowed as late as September 15. The shallow plowed plot could be better firmed down. Double-disking ground early in the season to be plowed late gave a slightly increased yield. This was due to the fact that the disking kept the ground in better shape for plowing, and it firmed down more readily than the undisked ground.

Listing.—Listing has not proved especially successful as a method for preparing a seed-bed for wheat, giving a less yield than early or medium early plowing. Listing has not proved a cheap method at this Station during the past two years, due to the heavy summer rains that have made frequent harrowing and disking necessary in order to keep down the weeds.

Disking.—The same condition has made it very expensive to prepare a seed-bed for wheat by disking without plowing. It required eleven diskings in 1908 to prevent the growth of weeds and prepare a good seed-bed by this method. Disking has also resulted in a low yield, producing the least amount of wheat and the lowest net profit of any method employed in this experiment.

CONCLUSIONS DRAWN.

The soil conditions and environment suitable for the successful growth of a wheat crop are well established and fairly well understood. With good seed, a few simple factors largely determine the stand and the yield of the crop and the quality of the grain produced.

In order to secure the ideal condition for seed germination and plant growth, a seed-bed for planting wheat and other small seeds should not be mellow to too great a depth, but rather the soil should be mellow and well pulverized only about as deep as the seed is planted. Below that depth the soil should be firm and well settled, making a good connection with the subsoil, so that the soil water stored in the subsoil may be drawn up into the surface soil.

The firm soil below the seed, well connected with the subsoil, supplies the moisture to the seed, while the mellow soil above the seed allows sufficient circulation of air to supply oxygen and favors the warming of the soil, gathering the heat of the sunshine during the day and acting as a blanket to conserve the soil heat, maintaining a more uniform temperature of the soil during the night.

The mellow soil above the seed conserves the soil moisture, acting as a mulch to keep the water from reaching the surface, where it would be rapidly lost by evaporation, and the same condition favors the growth of the young shoot upward into the air and sunshine.

The too-mellow, deep seed-bed is almost wholly dependent upon rains for sufficient moisture to germinate the seed and start the young plants. In such a seed-bed, drouth is very apt to injure the crop because of the rapid drying out of the loose soil to the depth of the plowing. In the loose seed-bed the crop is not very apt to "burn out" in summer, but it is also more apt to "freeze out" in winter than a crop grown in the "ideal" seed-bed described above.

Approved:
ED. H. WEBSTER,
Director.

Manhattan, Kan., August 9, 1909.

9-4-'09—30,000

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 3.

DEPARTMENT OF AGRONOMY.
A. M. TENEYCK, Agronomist in Charge.

Improved Seed Wheat.

BY

A. M. TENEYCK,
Professor of Agronomy.

THERE has been a great deal of interest developed during the last two or three years in better seed wheat for Kansas. Kansas is noted for her hard red winter wheat, the best flour-making wheat in the world. The "Turkey" wheat was introduced into this state some twenty-five years ago from Russia. Several large importations of Russian wheat have been made since that time, but there have been none of very recent date in large quantities. During the last ten years the United States Department of Agriculture, through the efforts of M. A. Carlton, cerealist, has investigated the growing of wheat in Russia and other European countries, and has secured a large number of samples of some of the best varieties adapted for growing in this country. During the past seven or eight years several hundred varieties or samples of wheat secured from all parts of the world have been tested in trial plots by the Experiment Station at Manhattan, Fort Hays and McPherson. Of the hundreds of samples of wheat tested in this state comparatively few have proven superior both in yield and quality of grain.

A TEST OF VARIETIES OF HARD WHEAT.

Eighty-two varieties or different samples of wheat were grown in the trial plots at the Manhattan Station last season. In table I are given the 1909 yields and the average yields for two, three and five years of the better producing varieties of hard red winter wheat which have been tested three years or longer.

TABLE I.—A COMPARISON OF VARIETIES OF HARD RED WINTER WHEAT.

Tested at the State Experiment Station at Manhattan, Kan. Arranged in order of average yield for three years.

Record No.	NAME OF VARIETY.	Seed from—	Date received.	Yield per acre, bushels.			
				1909.	Average for two years, 1908 and 1909.	Average for three years, 1907 to 1909.	Average for five years, 1905 to 1909.
382	Kharkof, U. S. No. 7786	Fort Hays Branch Station	1903	52.81	46.27	47.39	44.11
373	Defiance	Iowa Seed Company	1903	54.98	47.57	47.22	46.26
839	Hard Red Winter	Botany Department Kansas Experiment Station	1903①	52 61	45.36	46.31	45.32
366	Bearded Fife	Nebraska Experiment Station	1903	54.04	45.75	44.93	45.07
368	Malakoff	Ratekin Seed Company	1903	52.52	44.37	44.93	44.46
570	Turkey Red, U. S. No. 1558	McPherson Branch Station	1904	50.94	43.19	44.79	45.34
829	Roumanian, U. S. No. 1656	McPherson Branch Station	1905	51.92	44.38	44.59	....
574	Crimean, U. S. No. 1437	McPherson Branch Station	1904	56.62	45.93	44.55	43.04
380	Turkey Red	Nebraska Experiment Station	1903	49.05	44.88	44.43	42.68
369	Minnesota, No. 529	Minnesota Experiment Station	1903	48.82	43.96	43.36	42.97
846	"Old Crimean"	S. O. Thompson, McPherson, Kan	1905②	49.89	43.49	42.76	....
1014	Burger	J. J. Burger, Reserve, Kan	1906	49.98	42.10	42.72	....
838	Padui, U. S. No. 1582	Fort Hays Branch Station	1905	48.25	42.63	42.65	....
821	Hungarian, U. S. No. 2034	McPherson Branch Station	1905	47.33	42.58	41.55	....
576	Weisenburg, U. S. No. 1563	McPherson Branch Station	1904	47.70	42.50	41.53	41.71
835	Bacska, U. S. No. 1562	Fort Hays Branch Station	1905	46.48	41.15	40.94	....
573	Kharkof, U. S. No. 1442	McPherson Branch Station	1904	49.71	40.08	40.84	42.03
385	Ghirka, U. S. No. 5637	Fort Hays Branch Station	1903	52.81	40.39	39.70	38 28
907	Botany, No. 415	Botany Department Kansas Experiment Station	1905	51.55	44.20	39.13	....

1. Seed of Turkey wheat secured from Iowa in 1900, probably had been imported several years previous.
2. Grown in McPherson county since 1897, originally from Crimea, Russia.

NOTE.—All of these varieties are the bearded, white chaff, hard red winter or Turkey type of wheat, except No. 385, "Ghirka." This is a beardless, white chaff, hard red wheat.

It will be observed that of these nineteen varieties eighteen are the hard red bearded type of wheat commonly known as "Turkey." The Ghirka is the only exception; this is a beardless wheat, having a hard red grain similar to that of the Turkey. This variety has been greatly improved in quality by selection and is gradually improving in yield, equaling the Kharkof in 1909.

PROMISING NEW VARIETIES TESTED IN 1909.

In 1907 the Kansas legislature authorized the State Experiment Station to investigate the wheat of foreign countries, with a view of importing seed wheat. Such investigations were made by Burkett and Roberts* in Europe and Siberia and by TenEyck in Alberta, Canada. The report of these investigators was adverse to importing large quantities of foreign grown seed wheat. They recommended the importation of small quantities of the choicer varieties for testing, and the selection of the best of these for propagation, to secure sufficient quantity of seed for distribution. A number of such varieties were secured and planted at Manhattan, Fort Hays and McPherson. Twenty-six of these varieties of Russian wheat were planted at Manhattan in the fall of 1908. Six of these entirely winter-killed. A few of the varieties gave excellent results in the single trial. The yields in 1909 of several of the best producing varieties are as follows: Banatka, 55.26; Champanka, 53.06; White Awnless, 52.27; Ozucka, 51.14; Russian No. 1208, 50.97; Byelokolasska, 50.67; Egyptian, 50.26, bushels per acre, respectively.

Six samples of wheat from Alberta, Canada, were planted at Manhattan. The three best producing varieties gave an average yield last season of 55.11 bushels per acre. A sample of Turkey wheat from Montana, just south of the province of Alberta, made a yield of 50.81 bushels per acre, while a sample of "Old Turkey," secured from S. A. Renner, Rush Center, Kan., yielded 52.19 bushels per acre. This wheat is also of superior grade and quality. Mr. Renner has grown this Turkey wheat in Rush county for more than twenty years.

A TEST OF VARIETIES OF SOFT WHEAT.

While the "hard red winter" is the type of wheat generally adapted for growing throughout central, western and northern Kansas, in the eastern part of the state, and especially in

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* See Press Bulletins Nos. 157, 164 and 171.

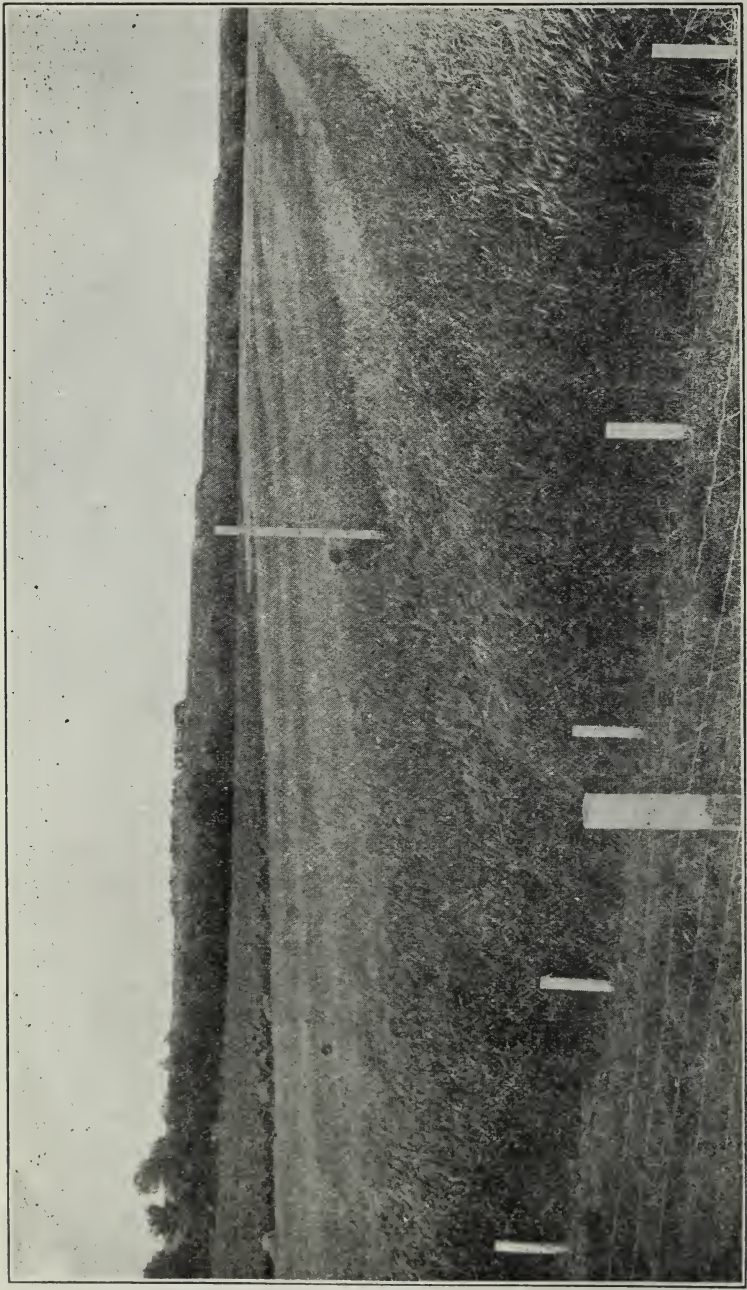


PLATE I.—Variety Trial; varieties of Winter Wheat.

the southeastern counties, the soft red winter wheat succeeds as well or often better than the hard red winter wheat. In some of the eastern counties of the state the hard and soft types of wheat may produce equally well, but in these counties the hard wheat is usually better adapted to the upland and the soft wheat to the bottom land and more fertile soil. In the wetter, warmer climate of southeastern Kansas hard wheat rapidly deteriorates in quality, becoming soft. A good grade of soft wheat may be produced under such conditions and it will usually lodge less than hard wheat. Soft wheat becomes harder when grown in the counties further west, but does not become a true hard wheat, and is hence not adapted for these western counties. There is no grade or market for a wheat which is neither "hard" nor "soft." There is a growing demand for improved seed of soft red winter wheat in eastern Kansas and in the states south and east of Kansas. A few varieties of soft wheat have been grown each year at Manhattan and at McPherson, in comparison with the hard wheat. In 1905 the Agronomy department began a more extensive test with varieties of soft wheat, securing from various sources a number of varieties. The comparative yield and other data for a number of the better producing varieties tested for three years or more are given in table II.

Wheat described in table II as "semi-hard" may become softer when grown under more favorable conditions. This test was made on upland. Seed for distribution was grown on bottom land in 1909. The yields of the several varieties on the bottom land are as follows: Zimmerman, 33.7; Fulcaster, 32.9; Fultz, 32.0; Currell, 29.9; Sibley's New Golden, 29.8; Kentucky B347, 29.7; Mediterranean, 20.5; Niger, 29.0; Oregon Red, 28.2; Poole, 27.8, bushels per acre, respectively.

It will be observed from the above data that Fultz, Currell, Fulcaster and Mediterranean are among the best producing varieties. The Zimmerman, though an excellent producing wheat some years, is variable; because of its very early maturing character it is apt to be injured by late frost in the spring. This is a standard variety and very commonly grown in eastern Kansas, and is better adapted for growing in the northern than in the southern counties of the state. Arctic Jr. and Kentucky B347 are among the better producing varieties, but the grain is white and has no local market or grade in this

TABLE II.—COMPARISON OF YIELDS OF SOFT WHEAT VARIETIES.

Tested at the State Experiment Station, Manhattan, Kan. Arranged in order of average yields for three years.

Record No.	NAME OF VARIETY.	Type.	Where from.	Date received.	Yield per acre, bushels.			
					1909.	Average for two years, 1908 and 1909	Average for three years, 1907 to 1909	Average for four years, 1906 to 1909
1023	Prosperity	Soft red−, bdls. w.c	Ike W. Crumly, Colby, Kan.	1906	42.97	37.33	39.67	....
852	German Emperor	Semi-hard red, bd. w.c.	Oklahoma Experiment Station	1905	39.35	37.76	38.61	....
831	Diehl's Mediterranean, U. S. No. 1395-2	Soft red, bd. b.c	McPherson Branch Station	1905	33.77	36.28	38.16	39.92
1021	Arctic Jr.	Soft white−, bd. w.c.	Ike W. Crumly, Colby, Kan.	1906	37.96	35.21	37.06	....
1020	Amber	Semi-hard red, bd. b.c	Ike W. Crumly, Colby, Kan.	1906	37.79	35.92	36.75	....
850	New Red Wonder	Semi-hard red, bd. w.c.	Oklahoma Experiment Station.	1905	34.01	34.36	36.59	....
817	Mediterranean	Soft red, bd. w.c.	Tennessee Experiment Station.	1905	42.92	35.23	35.91	37.35
809	Kentucky B, No. 347	Very soft white, bdls. b.c.	Kentucky Experiment Station.	1905	37.42	31.32	35.71	38.97
815	Fulcaster	Soft red+, bd. w.c.	Tennessee Experiment Station.	1905	42.01	35.18	35.01	36.79
816	Poole	Soft red−, bdls. b.c.	Tennessee Experiment Station.	1905	42.02	34.76	34.95	37.75
367	Fultz	Soft red. bdls. w.c	Barteldes Seed Co.	1903	40.15	33.59	34.55	38.69
818	Niger	Soft red. bd. w.c.	Tennessee Experiment Station.	1905	36.30	33.06	34.28	34.93
813	Dawson's Golden Chaff	Soft red, bd. w.c	Kentucky Experiment Station	1905	32.23	31.71	34.13	37.06
577	Currell	Soft red−, bdls, b.c.	McPherson Branch Station	1904	43.40	34.15	33.15	37.48
853	Sibley's New Golden	Soft red, bd. w.c.	Oklahoma Experiment Station.	1905	21.15	25.21	31.45	....
847	Red Russian	Semi-hard red, bdls. b.c	Oklahoma Experiment Station.	1905	29.15	28.29	31.29	....
1022	Iron Clad	Semi-hard red, bd. w.c.	Ike W. Crumly, Colby. Kan.	1906	30.80	29.84	30.78	....
819	Red May	Soft red, bdls. b.c.	Tennessee Experiment Station.	1905	32.66	28.41	30.74	33.84
377	Zimmerman	Soft red+, bdls. w.c	Fielding & Sons	1903	43.30	32.28	30.00	32.39
848	Oregon Red	Soft red. bdls. w.c	Oklahoma Experiment Station.	1905	34.02	31.31	....	....
380	Turkey (check)	Hard red, bd. w.c.	Nebraska Experiment Station	1903	34.44	37.58	39.56	41.30

−, indicates wheat is quite soft.
+, indicates a tendency to hardness.
bdls., indicates beardless.
bd., indicates bearded.
w.c., indicates white chaff.
b.c., indicates brown chaff.

state. Millers and grain dealers will buy it only as mixed wheat at a reduced price.

PROPAGATION AND DISTRIBUTION OF SEED WHEAT.

In order that the testing of varieties of wheat or other grains by the Experiment Station shall become of permanent value to farmers, seed selection, propagation and the distribution of the improved seed has been a special feature of the work of the Agronomy department. Some varieties of wheat are superior to others in hardiness, quality and productiveness. The tests at the Experiment Station have been verified by the reports received from farmers who have planted the College-bred seed. A farmer is well repaid for planting the purer seed of one of these better producing varieties.

During the four years preceding 1909 the Experiment Station, through the Agronomy department, distributed 3995 bushels of improved seed wheat among 638 farmers in 90 counties of this state. A small quantity of seed has been distributed in Oklahoma and other states. The Fort Hays Branch Experiment Station during the last five years has distributed 3980 bushels to 563 purchasers, mainly in the western counties of the state. The McPherson Coöperative Station has also distributed small quantities of good seed wheat. The crops from this better wheat have been largely saved for seed and planted again by the growers and their neighbors, and it is a safe estimate that 200,000 acres of this improved wheat were grown in this state last season, and two or three million acres of this wheat may and doubtless will be planted in the fall of 1909.

The distribution of this improved seed has already increased the average yield of wheat in several counties, and it is not only possible but probable that several million bushels will be added to our Kansas wheat crop in 1910 through better seed alone, and there should be a corresponding improvement in the grade or quality of the grain.

WHEAT SOLD BY AGRONOMY DEPARTMENT, FALL OF 1909.

HARD WHEAT.

KHARKOF, No. 382—300 bushels. A hard red winter wheat of the bearded Turkey type. One of the best producing varieties and an excellent milling wheat, as shown by the tests at this Station and by several trials by millers on a large scale. This variety is well adapted for growing through the central and western part of the state—the hard wheat belt. It succeeds well also in eastern Kansas wherever hard wheat is adapted to growing.

PLATE II.—A field of Kharkof Wheat.

TURKEY RED, No. 380—400 bushels. Similar to Kharkof; perhaps a trifle harder and darker in color, especially in eastern Kansas, where Kharkof is apt to be lighter in color and softer, containing some yellow berry.

TURKEY RED, No. 570—50 bushels. Similar to Turkey No. 380, having a little smaller berry, but of good quality.

MALAKOFF—22 bushels. Similar to Turkey No. 570. Recommended for eastern and northern Kansas.

BEARDED FIFE and DEFIANCE—40 bushels. These varieties are similar, being the Turkey type of wheat and very excellent yielders at the Station and in eastern Kansas, but not so well adapted for growing in the counties further west. Berries fully as hard as the Kharkof when grown in the eastern counties, but more inclined to yellow berry in the wheat belt counties, and not good varieties for resisting drouth.

CRIMEAN, No. 1125—90 bushels. Similar to Kharkof, but lodges less in wet seasons and gives a better quality of grain. This variety is well adapted to south-central Kansas, as shown by the tests at McPherson. The wheat is of more recent importation than the Kharkof, and may prove superior to the Kharkof in the warmer, wetter climates.

HARD RED WINTER, No. 839—20 bushels. This variety of wheat is of the Turkey type, and has been grown at this Station since 1900. The sample came from Iowa, and was doubtless from an early Russian importation. This variety has been given careful selection at this Station and has been improved in productiveness and in quality of grain. No better grade of wheat is produced on the Station farm than this hard red winter. This variety has not succeeded so well at Fort Hays and cannot be recommended for the western part of the state, but should give good results in the central and northern counties.

GHIRKA—100 bushels. This is the only variety of beardless hard red winter wheat which has proven worthy of continued trial and propagation. The Agronomy department has improved this wheat by selection and its yield has gradually increased, being equal to that of the Kharkof last season. The wheat is not fully pure, but contains about two per cent. of bearded heads—evidently a cross, which is very difficult to breed out. The grain is somewhat smaller than the Kharkof, but of good color and quality. This variety has the advantage of being beardless, and can be recommended for trial throughout the hard wheat belt, and especially for the south-central part of the state, since it gives equally good results at the McPherson Station.

SOFT WHEAT.

ZIMMERMAN—30 bushels. A soft or semi-soft red, beardless wheat. One of the earliest maturing varieties and a fairly good producer, but somewhat uncertain since it is more apt to be injured by late frosts in the spring than other later maturing varieties. On this account the variety is not recommended for the southern part of the state, but succeeds well in the northern and the northeastern counties, where it is quite extensively grown. The Zimmerman is an old standard variety.

FULTZ—125 bushels. A soft red, beardless wheat. An old standard variety, more generally grown perhaps throughout the soft wheat belt than any other variety. This is the red Fultz; our strain is not fully pure, containing about two per cent. of bearded heads, which appear to be a cross, since we have not been able to eliminate the mixture by selection. Otherwise this is an excellent strain of Fultz wheat and produces well at this Station. It may be recommended for growing in the eastern and southeastern parts of the state.

CURRELL—20 bushels. Soft red, beardless wheat, but with brown chaff. Quality of grain similar to that of the Fultz variety. Appears to be well adapted for growing in the southern part of the state.

FULCASTER—140 bushels. A soft red, bearded wheat. A good producer and generally adapted for growing in the soft wheat belt. Quality of grain similar to that of the Fultz. Does not shatter—a fault which is characteristic of many other bearded varieties of soft wheat.

MEDITERRANEAN—20 bushels. A soft red, bearded wheat. Grain somewhat larger but similar to the Fulcaster. A good producer, but shatters some when fully ripe.

We have a few bushels each of other varieties; namely, Oregon Red, Sibley's New Golden, Niger, and Kentucky B No. 347. For description see table II.

The above varieties of wheat sold at $2 per bushel for graded seed, sacked, f. o. b. Manhattan. The wheat crop at the Fort Hays Branch Station was entirely destroyed by hail. Parties desiring to purchase College-bred seed wheat are referred to growers who have previously secured seed from the Experiment Station. A list may be secured by addressing the Agronomy department, Manhattan, Kan.

SEED WHEAT FOR SALE BY GROWERS.

Press Bulletin No. 172, published last winter, gave information regarding the work of the College and Experiment Station in testing and distributing good seed wheat.

A systematic effort has been made to locate and list the growers of good wheat who have seed wheat for sale this fall. Prof. C. S. Knight, assistant in the Agronomy department, made a trip through a number of the wheat counties of the state about harvest time. Visiting many of the farmers who are growing College-bred wheat he made a personal inspection of their fields, noting mixture with other grain, with other varieties of wheat, and other general characteristics of the crop. The department also sent out several hundred blank forms asking for reports from growers who had secured seed from this Station or from the Fort Hays Branch Station. In this way nearly one hundred growers have been listed who have College-bred seed wheat for sale. The whole amount listed aggregated 88,000 bushels of fairly pure seed wheat. Attention should here be again called to the fact that pure wheat cannot be grown on ground that has volunteer wheat of different variety upon it.

A large number who replied to our letter or who were visited by Professor Knight stated that they would use their entire crop for seed, or that their surplus seed wheat had already been spoken for by neighbors. Thus hundreds of thousands of bushels of this improved wheat will likely be seeded this fall, in addition to that listed for sale. This list is now published and will be sent to all who request it.

REPORT FROM GROWERS.

This department has recorded the name and address of each purchaser of seed wheat, and for the past three seasons blank forms have been sent to nearly all of the growers at about harvest time, with the request that they report results. Among several hundred replies very few unfavorable reports have been received. The reports are mainly on Kharkof and Turkey Red wheat, and are often very favorable. The College-bred wheat has been reported in several cases as giving fifty per cent. greater yield than the common or average wheat grown in the neighborhood. Many report an increase in yield of five to ten bushels per acre as compared with other ordinary wheat grown in the same field.

A careful analysis of these reports leaves no doubt that the Kharkof and Turkey Red wheat distributed by this Station is superior to much of the "scrub" wheat or average common "Turkey" which is now being grown in the state. As compared with other varieties the College wheat is reported as being more vigorous, healthier, a better drouth resister, maturing earlier and lodging less than the average wheat which has received no selection or breeding. The grain produced is also reported as of good weight and quality, many reporting the crop of 1909 as weighing over sixty pounds per bushel.

By its more vigorous growth the Kharkof and Improved Turkey wheat may resist attacks of the Hessian fly to a somewhat greater extent than the average scrub wheat. As a rule, however, no particular advantage is claimed for the wheat on this point. On the whole, therefore, considering the trials at the Experiment Station and the reports of growers, there is no question but that the seed wheat distributed by this Station has been improved in productiveness, hardiness and in quality of grain, and where hard red winter wheat is adapted for growing the College-bred varieties will succeed better than the wheat which has not been so carefully selected, tested and graded. The difference is in the breeding and selection as well as in the variety. This work in breeding has just begun. Several improved and pedigreed strains have been produced in the last two or three years and are now being propagated, and will be ready for distribution in the next two or three years. This wheat will be better than anything distributed up to the present time.

Approved.
ED. H. WEBSTER, *Director*.
MANHATTAN, KAN., September 1, 1909.

Approved.
ED. H. WEBSTER,
Per E. R., September 9, 1909.

11-4-'09—30,000

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 4.

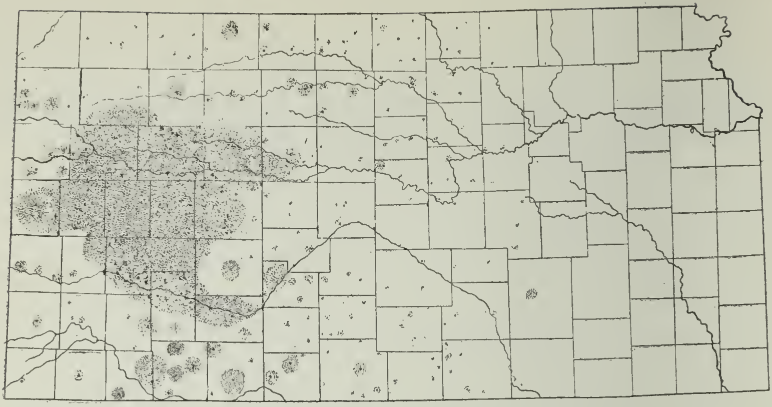
DEPARTMENT OF ENTOMOLOGY.
T. J. HEADLEE, Entomologist and Zoölogist in Charge.

Prairie-Dog Situation.

BY
THEO. H. SCHEFFER,
Assistant in Zoölogical Investigation.

HISTORY OF THE WORK.

IT is now a little more than four years since the work of preparing and distributing poison for the destruction of prairie-dogs was relegated to the Department of Entomology and Zoölogy at the Experiment Station. Previous to that time —July, 1901, to July, 1905—this work was in charge of a special field-agent appointed by the regents of the Agricultural College in accordance with the provisions of legislative enactments in 1901 and 1903. This field-agent, Mr. D. E. Lantz, now with the Department of Agriculture at Washington, carried the war into the prairie-dog territory in a series of vigorous campaigns, which have since been followed up by attacks all along the line. During the time Mr. Lantz was in charge a number of publications on the subject were issued by the Station, beginning with Press Bulletin No. 97. This was followed in a few months by Press Bulletin No. 108, and that a year later by a regular Station Bulletin No. 116. During the legislative session of 1903 Press Bulletin No. 119 was sent out. The supply of this bulletin having become exhausted, Press Bulletin No. 130 appeared in January, 1904. The most of these publications gave also some space to a consideration of the pocket-gopher. The Lantz series was concluded in 1905 by a general treatise on Kansas mammals in their relation to agriculture—Station Bulletin No. 129—in which the prairie-dog was given special attention. About a



Distribution of the prairie-dog in Kansas, as indicated by sales of poison. The number of dots clustered about the various shipping-points or country post-offices in the state represents the number of quarts of prairie-dog poison sent out by the Station to these places. This is a rough index of the local occurrence or absence of the pest in destructive numbers.

year later Prof. E. A. Popenoe prepared a short statement for the press under the title of Press Bulletin No. 153.

RECENT INVESTIGATIONS.

For a number of reasons it has seemed desirable to publish again on the subject at this time. All supplies of the above bulletins that were available for distribution to those interested have become exhausted. Then, too, a number of new and interesting phases of the work in its present stage of progress are worth presenting. The writer has just completed an extended and careful survey of the prairie-dog territory of western Kansas lying between the Union Pacific railroad on the north and the Santa Fe line on the south. Over most of this extensive scope of country the prairie-dog is no longer a factor to be reckoned with by the farmer and stockman. To such an extent has the little animal become a thing of the past in many localities that the occasional isolated "dog-town" is now looked upon by the residents as a matter of interest and old-time association rather than as a nuisance. On the other hand, in several quarters of the West, particularly along the flats and breaks adjacent to the Smoky Hill river, the prairie-dog has yielded ground but slowly and still constitutes a serious menace to stock grazing and dry-land farming.

LEGAL PHASE.

Three special legislative acts have given impetus and direction to the work of destroying prairie-dogs. The first law, passed in 1901, organized the campaign by providing for experimentation and the appointment of a special field-agent. Under its provisions township auditing boards were authorized to act on petition. They were limited, however, to an expenditure of $100 per year, except by consent of two-thirds of the residents of the township. The act of 1903 made it the duty of the township trustee to inspect all lands infested by prairie-dogs and to report to the county commissioners the estimated cost of putting out the poison or using other measures for exterminating the pests. Based on these estimates the commissioners were authorized to make a special levy not exceeding five mills on the dollar. Supervision of the work was left to the trustee, who might employ such help as he needed. At the last session of our legislature (1909) this law was repealed, but its main provisions were reënacted into a new law, with an additional clause imposing a fine upon trustee or commissioners for non-fulfilment of the law's provisions and raising the maximum levy to seven mills. As matters now stand any resident whose lands are infested by prairie-dogs can compel the proper officers to take steps for their eradication.

THE STATION'S METHOD OF COMBATING PRAIRIE-DOGS.

After a few months of experimentation in 1901, Mr. Lantz adopted poisoning as the cheapest and most easily applied method of ridding our western lands of prairie-dogs. The right to use a certain formula, protected by letters patent, was purchased for the state, and we have ever since followed this formula pretty closely in the preparation of our poison mixture. That it probably does the work as efficiently and as thoroughly as any substance or means which might be discovered or devised is attested by the almost universally favorable reports on its use and by the disappearance of the hordes of prairie-dogs from the farms and cattle ranges of the West.

The poison mixture is in the form of a syrup, prepared as follows:

INGREDIENTS FOR ONE QUART OF SYRUP.

1 oz. strychnia sulfate (powdered).
1 oz. potassium cyanide.
1½ ozs. alcohol.
1 pt. syrup.

Preparation.

One ounce of green coffee-berries is mixed with the white of one egg and allowed to stand at least fourteen hours.

The strychnia is dissolved in a half-pint of boiling water. The potassium cyanide is dissolved in a quarter-pint of hot water and allowed to cool.

Add a little warm water to the mixture of coffee and eggs and mix it with the potassium cyanide. Then strain this mixture through a coarse sieve into the mixing vessel and add the syrup. Mix the alcohol with the hot solution of strychnine and add it to the other mixture. Stir all thoroughly.

This mixture is put up in cans of two sizes—quart and half-gallon. It is intended to be used with wheat or Kafir-corn as bait.

HOW TO OBTAIN THE POISON.

The preparation and sale of the prairie-dog poison is not a commercial proposition with the College, as the work is carried on in pursuance of the policy of the institution to extend its usefulness along as many lines as possible to the classes of people who helped to create it. We put a price upon the poison which is intended to cover approximately the cost of materials and preparation. At present the poison-syrup sells at $2 per half-gallon can, or $1.10 per quart can. Orders may be sent directly to the department or simply addressed to the College, but all remittances, except in currency, should be made payable to Miss Margaret Butterfield, secretary of the College. As there is no margin of profit in the business there must likewise be no loss, so we cannot undertake to send poison to persons unknown to us unless the order is accompanied by remittance. We make an exception to this rule in the case of orders sent in by the proper officers.

HOW THE POISON IS SHIPPED.

Single cans of poison are securely wrapped and sent, usually, by express. Two cans may be wrapped together and sent in the same way, but larger orders are boxed. Shipment of poison by mail is contrary to postal regulations. The purchaser should always state whether he wishes the poison sent by express or freight. If left to us we ordinarily send the small shipments, at least, by express. In ordering poison give both your post-office address and nearest shipping-point. We advise you by mail the day that shipment is made. If there is delay in receiving shipment or if any of the cans are damaged and leaking write us at once.

MIXING AND PUTTING OUT THE BAIT.

Failure to get good results can be traced in every case to carelessness or neglect of specific and simple directions in using the poison. The following directions for use are printed on the label of every can:

Directions for Use.

"For every quart of syrup take a half-bushel of clean wheat or Kafir-corn in a large metal tub. After thoroughly shaking and stirring the contents of the can, pour it over the grain and stir until every part is thoroughly wet with the poison. Then stir in two or three pounds of fine corn-meal, to take up the extra moisture. Let the mixture stand in a shed over night and put it out early the next morning if the weather is fine. Place half a tablespoonful or less of the bait in two or three little bunches at the outside of each burrow occupied by prairie-dogs. Only occupied burrows should be poisoned. A half-bushel of grain should poison from 500 to 600 holes."

STIRRING THE SYRUP.—Special pains should be taken to see that the contents of the can are thoroughly mixed before being poured over the grain. The two poisons, strychnia and potassium cyanide, are insoluble in the presence of each other and settle to the bottom of the can like the lead in mixed paints. When used in cool weather, as is usually the case, the cans should be set in hot water for a short time and then shaken thoroughly while in an inverted position. It may even be necessary in some cases to stir the contents of the can with a stick.

WHEN TO POISON.—While some degree of success may be attained by putting out our prairie-dog poison at any season of the year, we do not advise its use except in winter and early spring. When fresh grass or other vegetation is to be had the little animals do not take the poison bait readily. Any bright sunshiny day in January, February or March is favorable for poisoning operations, provided it warms up enough to bring the "dogs" out for an airing. The very best time is a period of thaw following stormy weather, especially when the latter was accompanied by snow. When the thaw succeeds the storm the prairie-dogs wake up and crawl out "hungry as bears" and ready to eat anything in sight. The person who has the poisoning in charge must use his judgment as to favorable days for work. It is of no use to put out poison when the "dogs" will not come out. Much money has been wasted in certain townships by keeping a gang of men steadily at work poisoning for two or three weeks at a time, when some of the days were rainy or stormy. Under such conditions the potassium cyanide rapidly deteriorates and, if rainy, the strychnia is also dissolved out and lost. Then, too, for the sake of our valuable birds the poison ought not to be put out except at times when it is likely to be quickly taken by the animals for which it is intended.

TOWNSHIP METHODS.

DUTIES OF THE TRUSTEE.—In all townships infested by prairie-dogs the trustee is required by law to purchase poison and to have the oversight of putting it out, or to use such other materials and appliances as he may deem necessary to destroy the "dogs." He is allowed $2 per day for this supervision, and may hire as many helpers as he needs, paying them $1.50 per day. In the exercise of this latter function the trustee ought to use the same judgment and care that he would in hiring men to work for himself. The writer listened to many complaints recently from taxpayers who stated that young boys or irresponsible men were sent out to do work that requires the maximum of care and judgment. The poison bait is often disposed of in any way to get rid of it instead of being deposited carefully in little piles about the entrance to the prairie-dog burrows. Not only this, but it is left in situations where the lives of valuable birds and domestic animals are constantly endangered.

GIVING OUT THE POISON.—In some townships the trustee adopts the plan of distributing the cans of poison among the residents of his township and letting them put it out on their own lands without compensation. This plan is hardly within the contemplation of the law, but it has some advantages—as well as disadvantages. It enables the scattered settlers in large townships to clear the prairie-dogs off their own lands and adjoining borders of the lands of non-residents. Some of these western townships are very large—twelve miles square, or even twelve by twenty-four miles in extent—and trustees claim that the expense of hiring men to put out poison over such an extensive tract would more than bankrupt their treasury. Another advantage of the plan lies in the fact that men will ordinarily exercise more care in putting out the poison on their own lands than might be expected of persons hired by the trustee. Objections to the plan are, first, that the lands of non-residents are left as breeding-grounds for the prairie-dogs. Sometimes these lands constitute the bulk of the territory in a township or county. Again, by giving out a half-gallon can of poison to each landowner who requests it, much of the poison is wasted or allowed to stand around for years to deteriorate. Often the few "dogs" on an individual farm could be destroyed by the use of a pint of the poison, or even less.

GIVING OUT THE BAIT.—If the plan of giving out the poison to residents of the township is followed, it would be well to order some cans of the smaller (quart) size. A few trustees have told me, however, that they can get more and better results for the township's money by carefully mixing the poisoned bait themselves and giving it out ready for use to those who need it.

ORGANIZING THE WORK.—In the case of several large townships that were badly infested by prairie-dogs the trustees have organized the campaign against them by appointing an overseer of the work in each road district—sometimes the road overseer himself. These overseers were then authorized to secure as much help as they severally needed. In distributing the bait the men worked back and forth over their districts, taking as wide a strip each time across as they could conveniently cover.

USING THE POISON FOR GROUND-SQUIRRELS.

The little striped ground-squirrel or spermophile, *Spermophilus tridecemlineatus*, is very troublesome in most sections of the West, and the practice of using some of the prairie-dog poison for destroying these little pests has become very general. In case any considerable quantity of poison is needed for destroying spermophiles we would advise the purchase of our specially prepared pocket-gopher poison. This syrup lacks the potassium cyanide, and has been found by experience to be better adapted to destroying rats, mice and ground-squirrels than the prairie-dog poison. It is put up in quart cans only and is sold at the same price as the smaller cans of prairie-dog poison.

Approved:

ED. H. WEBSTER, *Director*.

MANHATTAN, KAN., October 23, 1909.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 5.

DEPARTMENT OF ENTOMOLOGY.
T. J. HEADLEE, Entomologist and Zoölogist in Charge.

Chinch Bug.

BY
J. B. PARKER,
Assistant in Entomological Investigation.

INFESTATION AND DAMAGE.

Last season the chinch bug did a large amount of damage in parts of Kansas. A glance at the map will show that the area of infestation covers a large part of the corn belt of the state. The Nebraska line on the north, the Oklahoma line on the south, a line joining Phillips and Harper counties on the west and another joining Republic and Crawford counties on the east, roughly bound the infested district. Our correspondents in the counties within this territory, in reporting the damage to corn by chinch bugs, variously estimate the loss at from five to fifty per cent of the crop. The damage is reported

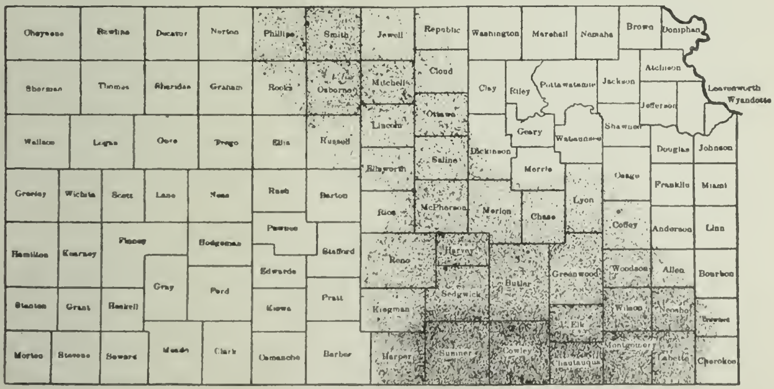


FIG. 1. Map showing approximately the area over which the corn crop of 1909 suffered from chinch bugs a damage of five per cent or greater. The darker shading indicates the area of heavier damage.

lightest in the central part of the infested area, somewhat heavier in the northern part, and heaviest in the southern section, particularly in Sumner county, where the estimates of injury to corn vary from twenty to eighty-five per cent of the crop. Much difficulty is experienced in arriving at a satisfactory estimate of the damage caused by the bugs, owing to its close association with the injury the corn sustained from lack of moisture during the severe drought of late summer. To our mind, where bugs were abundant, of the total damage sustained by the corn that part which was due to the direct effect of the dry weather was of less importance than that which the prolonged drought enabled the bugs to do. The injurious effect of their work was increased by weather conditions that favored the bugs and at the same time deprived the corn of its powers of resistance to their attack. Consequently much of the damage attributed to the effects of the dry weather may in many cases justly be accredited to the work of the chinch bugs.

DANGER.

We are at this time, however, far less concerned with what damage the dry weather occasioned than we are with the fact that it provided the bugs with ideal conditions under which to thrive and multiply. That they made the most of their opportunity is amply shown by the numbers that developed in the cornfields. When we remember that practically all these bugs passed safely from the ripened corn into winter quarters, where they await the coming of spring to begin their attack upon the wheat, we can readily understand the danger that threatens the cereal crops of 1910. If between now and the advent of warm weather next spring these bugs are not destroyed, either by natural agencies or by the farmers themselves, we may expect to see the wheat fields next May overrun by the same horde of bugs that developed in the corn last summer.

WHERE THE BUGS ARE NOW.

As is well known, when the cold weather of autumn comes on the chinch bugs abandon their feeding grounds and betake themselves to flight in search of winter quarters, in which they remain in hibernation until the following spring. The current belief, however, that the majority of the bugs pass the winter among cornstalks, in hedgerows, straw stacks and heaps of rubbish about the farms is not borne out by our investigations. When the bugs are abundant, as they are in Sumner county, a few may be found in any of the situations named above—in fact we have found no place covered with vegetation wholly free from them—but the threatening mass of bugs is to be found in *clumps of bunch-grass and among bluestem* in pastures and mown meadows, along roadsides of highways and railroads and in neglected corners of cultivated fields. We have found but few bugs hibernating in fields covered with crab grass or foxtail, and not many wintering in the cornfields or in hedgerows that are devoid of native clump-forming grasses. In the meadows from which the native prairie hay has been mown great numbers of the bugs may be found tucked away about the roots of the grass or hiding behind the leaf sheaths of the stubble of bluestem. But the places most preferred, the ones that harbor the great majority of the bugs, are the clumps of bunch-grass. A single clump of this grass eight inches in diameter growing on a roadside bordered by a cornfield was found to contain twenty thousand chinch bugs.

How to Attack Them.

The situation of the hibernating bugs offers the farmer an excellent opportunity to attack them. To do this it will be necessary to run fire over all pastures, meadows, roadsides and neglected places where native grasses abound. Since the chinch bugs fly from their winter quarters into the wheat in the spring, this attack, if it is to be of the greatest efficiency, must be made by all the farmers or landowners over a continuous and extended area. Our experiments in burning this fall, made prior to the 15th of November, showed that the stems of bunch-grass and bluestem were, up to that date, too green and full of sap to burn down close to the ground. As a result, although countless numbers of the bugs were destroyed in each trial, entirely too many escaped uninjured to warrant a general burning at that time. It is, however, our conviction that even when burning is done under the most favorable conditions, a small percentage of the bugs—those that have worked their way down to the roots of the bunch-grass—will escape the fire. The best time, therefore, to make this general burning would be just before winter sets in, in order that those bugs escaping the fire might be forced to pass the winter without protection. Unfortunately the heavy rains of November and the early advent of winter have rendered that procedure impossible this year. Consequently the burning should be made just as soon as the grass in which the bugs are hibernating becomes dry enough to burn down close to the ground. The attack on the bug should not be delayed until spring, unless conditions should render it impossible to make it during the winter. The number of bugs hibernating in the cornfields does not seem to us sufficient to warrant the burning of the stalks. We urge that stalks and other litter in these fields be plowed under in the fall or early winter.

DON'T DEPEND ON NATURAL AGENCIES.

It is generally accepted that a rainy season is detrimental to chinch bugs, and it is possible that a fortunate combination of climatic conditions may destroy them in their winter quarters, or that, even if they do pass the winter successfully and escape to the wheat fields, weather conditions in the spring may, through the agency of disease, destroy them or their progeny and thus prevent a serious outbreak. But the conditions that govern natural agencies inimical to the chinch bug are wholly beyond our control. To rely upon such contingencies for relief is to place dependence upon chance; and to trust to chance to rid us of a pest so dangerous as the chinch bugs threaten to become next year, when it is possible to destroy them in their winter quarters, seems to us to be extreme folly.

FUNGUS NOT ALWAYS EFFECTIVE.

Another matter that calls for consideration is the widespread and erroneous belief that if the chinch bugs become dangerous next year they can, regardless of weather conditions, be controlled by the introduction of a fungous disease among them. Our investigations show that this fungus (*Sporotrichum globuliferum*), though present among the bugs, will not always control them. In June of this year wheat fields in Harvey and Sumner counties were examined, and wherever chinch bugs were found there also the fungus was present. During July the Station had an agent in the field in Sumner county collecting chinch bugs that had died of this fungous disease. When, on October 1, we resumed our study of the chinch bug in the field in this same county, we found scattered over the fields of corn and Kafir corn bugs dead and whitened with this "chinch bug fungus." In many places even as late as November 15, in their winter quarters in the same county, bugs in small numbers were dying of this disease. Here, then, is a case in which the bugs were more abundant and did more damage than in any other section of the state in spite of the fact that the disease was present among them continually throughout the season. If weather conditions had been favorable to the development of the disease it would doubtless have controlled the pest, but as matters went it did not do so, and no amount of artificial introduction of the fungus in this instance could have brought relief from the ravages of these insects. During October and November we made repeated attempts to introduce the disease artificially among the bugs massed together in clumps of bunch-grass by placing in their midst bugs whitened with the spores of the fungus. But in every instance we secured only negative results, while on other areas of the same field where the grass had fallen down in a tangled mat, the bugs hiding beneath it, on or near the ground, were dying of the disease. We therefore are of the opinion that if conditions are not conducive to the development of this fungus its artificial introduction among the bugs will result in failure, and that if conditions are suitable to its development the disease will spring up of its own accord. In fact, we have never during the past two years examined a field in which chinch bugs were at work in large numbers without finding traces of this disease among them. Whether artificial introduction of the fungus among the bugs will under favorable conditions materially hasten its action is a problem that calls for fundamental investigation.

SUMMARY.

1. The chinch bugs are hibernating in bunch-grass, bluestem and other native grasses in pastures, mown meadows, neglected places about the farm or along roadsides of highways and railroads.
2. If they are not destroyed by natural agencies or by the farmers they will prove disastrous to cereal crops next season.
3. It is not the part of wisdom to depend upon the "chinch bug fungus" to control the bugs.

4. Cornstalks, instead of being burned, should be plowed under in the fall or early winter.

5. As soon as the grass becomes thoroughly dry fire should be run over all pastures, meadows, roadsides and waste lands wherever bluestem, bunch-grass or other native clump-forming grasses are found.

Approved:
ED. H. WEBSTER, *Director*.
MANHATTAN, KAN, December 16, 1909.

H. S. Grindley.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 6.

DEPARTMENT OF AGRONOMY.
A. M. TenEyck, Agronomist in Charge.

VARIETY TESTS.

BY

A. M. TenEyck.

The Experiment Station has for years carried on a systematic study of varieties best adapted to eastern Kansas. Many inquiries are received for information concerning standard varieties, and this circular is issued to give as briefly as possible a statement gathered from our experiences with these varieties covering a period of from five to seven years. Many hundreds of varieties have been tested but those given in this circular are considered as best adapted to eastern and middle Kansas conditions.

DESCRIPTION AND ADAPTATION OF VARIETIES.

CORN.

More than 200 different varieties or strains of corn have been tested in comparative trial plots on the Experiment Station farm at Manhattan. The varieties named below have been grown from two to seven years and are among the better producers.

White Dent Varieties.

Boone County White.—Introduced from other states but grown and bred in Kansas, medium early, 115 days to mature, medium large ears; adapted for growing on bottom land and on good upland in eastern or central Kansas. This variety wins more prizes at the corn shows than any other variety of white corn.

Johnson County White.—From Johnson county, Indiana;

same as Boone County White in breeding and type, both varieties coming from the same original seed; adapted for growing in eastern Kansas on good corn land.

Commercial White Dent.—Introduced from Missouri, similar to Boone County White but smoother in type, one of the best producers in Missouri. It has out-yielded Boone County on upland in a trial of two seasons at this Station; recommended for eastern Kansas and may be a better poor land corn than Boone County.

Nebraska White Prize.—"Native" Nebraska corn, similar in type to Boone County, with somewhat smaller ears and a little earlier in maturing; recommended for northern Kansas.

Roseland White.—"Native" Kansas corn, medium late, 125 days, large ears, fairly large deep kernels; adapted to good corn land in east-central and southeastern Kansas.

McAuley White Dent.—"Native" Kansas corn, medium in maturing, 120 days, similar to Boone County but with smoother, larger kernels. A hardy variety adapted to upland and bottom land in eastern and middle Kansas.

Hammett.—"Native" Kansas corn, a little earlier than the Boone County, with shorter ears, hardy and adapted to upland in northern Kansas.

Silvermine.—A standard variety throughout the corn belt, a little earlier than Boone County, with somewhat smaller ears but usually deeper grains; a good early corn in eastern Kansas but less productive than Boone County at this Station. This variety may be grown successfully further west by adaptation.

Sandford's White Dent.—"Native" Kansas corn, similar to Silvermine but a better yielder, hardy and adapted for growing on upland or bottom land in central and northern Kansas.

Pride of Saline.—"Native" western Kansas corn, a crossbred variety resembling a smooth type of Silvermine but with shallower grains, has about the same maturing season as Boone County but hardier and more drought resistant. Has proved to be one of the best producing varieties at this Station during the last three, drier years. Recommended only for well watered bottom land in western and west-central Kansas and for upland further east.

White Pearl.—Medium early corn of smooth Silvermine type. Has produced well on upland during the past three seasons.

Yellow Dent Varieties.

Kansas Sunflower.—"Native" Kansas corn, medium late, 120 to 125 days, rather small ears with good type of grain of rich golden color and strong vitality; not a show corn but excellent for feeding, hardy and well adapted for growing on upland or bottom land in eastern and central Kansas. This variety is the highest producer at the Kansas Experiment Station in a seven years' trial.

Hildreth.—"Native" Kansas corn, late in maturing, 130 to 135 days, a very rank grower, with large ears and deep grain; best adapted for the east-central and southeastern portions of the state. Excellent show type and a prize winner and one of the heaviest producers on good corn land.

Reid's Yellow Dent.—A standard variety very generally grown throughout the corn belt, medium early, 110 to 115 days, medium sized ears with deep grain. A good medium early corn and a great prize winner but does not yield quite so well at this Station as other later maturing sorts; best adapted to eastern, northern and central Kansas.

Leaming.—A medium early corn with rather larger ears and coarser grain than Ried's Yellow Dent and a heavier producer, having about the same general adaptation.

Legal Tender.—Somewhat similar in type to Leaming, more cylindrical ears and a little later in maturing.

Hogue's Yellow Dent.—Introduced from Nebraska, medium early, 110 days, similar to Reid's Yellow Dent in type of ear and kernel but a little lighter in color, an excellent producer, outyielding the Reid at this Station; may be best adapted for central, northern and northwestern Kansas.

Hiawatha Yellow Dent.—"Native" Kansas corn, medium late, 125 days, a large-eared variety of the Leaming type. Adapted for growing in northern and eastern Kansas on fertile land; may give good results in the southern part of the state on good corn land, though for late corn the Hildreth may be preferred in southern Kansas.

OATS.

The varieties tested for seven years at the Kansas Experiment Station have been somewhat improved by grading and selection. Total number of varieties tested, 44. Prefer to sow oats early in the spring, two to three bushels of seed per acre.

Description and Adaptation of Varieties.

Improved Red Texas.—Highest yielder at this Station, generally adapted for growing in Kansas, preferred in the central, south-central and southeastern portions of the state.

Sixty-day.—Ranks second in yield for seven years' trial, a hardy variety and good drought resister; recommended for western and northern Kansas.

Kherson.—Ranks third in yield for seven years, reported as the best producing variety in Nebraska and Iowa, well adapted for northern and northeastern Kansas.

Burt.—One of the earliest maturing varieties, very hardy and a drought resister, recommended for western Kansas.

BARLEY.

Varieties tested five and seven years; total number tested, 32 varieties. Sow early in the spring two to two and one-half bushels per acre.

Improved Mansury.—Six-rowed bearded type, medium early, best producing variety in seven years' trial, generally adapted for growing, preferred for eastern and middle Kansas.

Improved Bonanza.—Similar to Mansury in type and yielding qualities and adaptation for growing.

Six-rowed Ellis.—Bearded type, good yielder, seed from Fort Hays Station, adapted for growing in western Kansas.

Stavropol.—Six-rowed bearded type, one of the earliest maturing varieties and a good producer, recommended for western and south-central Kansas.

Success Beardless.—Six-rowed barley without beards, has a general adaptation for growing, not so hardy and a little less productive than the best bearded varieties.

SPRING EMMER.

Emmer should be sown very early in the spring, about three bushels of seed per acre. This grain may take the place of barley or oats and may be somewhat more hardy and drought resistant but matures later, hence is likely to be injured by hot weather.

CANE.

The following varieties have been grown for several years at the Kansas Experiment Station and have been improved by the head-row method of breeding. The seed is practically pure and entirely free from smut.

Black Dwarf.—One of the earliest maturing varieties of the

Dwarf Amber type, especially recommended as a fodder cane and generally adapted for growing.

Early Amber.—A standard sort generally adapted for growing as a fodder cane, and also used to some extent for syrup production.

Kansas Orange.—A medium late maturing standard variety in Kansas, better adapted for growing in the central and southern portions of the state; a good syrup produce, also generally planted for fodder.

Texas Honey.—A late maturing, large, rank-growing variety; said to be a good producer of syrup.

Red Sorghum, U. S. No. 3.—Red Amber type, rather late in maturing, a good producer of forage and seed, adaptation not fully determined.

Sumac.—A small-seeded somewhat dwarf type; a hardy variety, and good fodder cane.

KAFIR CORN.

The College-bred seed has been improved by head-row breeding and is practically pure in type and entirely free from smut.

Black Hulled White.—A standard variety all over the state and preferred to the Red Kafir in southern and western Kansas.

Red Kafir.—A somewhat earlier maturing variety in eastern Kansas, producing more slender stalks with more leaves, and may be preferred for forage but does not usually produce quite so large yields of seed as the Black Hulled White.

BROOM CORN.

The Department has improved a variety of Dwarf broom corn by several years' breeding to secure straight brush and eliminate the center stem. There are two general types of broom corn, the Dwarf and the Standard. The Dwarf may be recommended for growing in the drier portions of the state—the Standard in the more humid portions.

MILO MAIZE.

The Dwarf milo maize may be recommended for growing in middle and western Kansas. The Department has for several years been breeding by the head-row method a variety of the Dwarf milo maize which is now quite generally distributed.

COWPEAS.

Cowpeas are generally adapted for growing throughout the state. The earlier maturing varieties are to be preferred in the northern and western part of the state, such as New Era, Groit, Gray Goose and Black Eye. For central and southern Kansas the above-named varieties may also be recommended, and also the Whippoorwill, a later maturing, ranker growing sort and a standard variety generally sold by seedsmen, as is also the New Era, these two varieties being preferred for general culture.

SOY BEANS.

The Early Yellow is the standard variety now grown in this state. This is an early maturing sort and may be especially recommended for the northern part of the state, while later maturing varieties such as Morse, Ebony and Meyer may give better results in southern Kansas. Soy beans are a less profitable crop and not so well adapted for growing in this state as cowpeas.

MILLET.

German millet is the standard variety of the fox-tail type, which is generally adapted for growing throughout the eastern and central portions of the state. Hungarian and Siberian are also grown, but are not quite so heavy producers as the German. For western Kansas prefer the Proso or broom-corn type of millet, such as the common "Hog" millet, Black Voronezh and Red Russian.

Approved:
ED. H. WEBSTER, *Director*.

MANHATTAN, KAN., February 14, 1910.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 7.

DEPARTMENT OF ENTOMOLOGY.

T. J. HEADLEE, Entomologist and Zoölogist in Charge.

CORN EAR-WORM.

BY

T. J. HEADLEE.

IMPORTANCE.

During each of the last two years not less than 3.5 per cent of the crop of corn Kansas should have produced has gone to feed corn ear-worms.[1] During 1908 all the fields about Manhattan averaged more than 60 per cent of the ears infested and many of them showed practically 100 per cent. Extensive traveling about the state indicated injury everywhere quite serious enough to raise the average above 50 per cent. In 1909 the corn fields about Manhattan exhibited an equally severe injury, and observations made in various parts of the state indicated that the injury at that time was no less severe than that of the year before. Nine hundred and ninety injured ears selected at random showed by actual count of grains that not far from 10 per cent of the grains had been destroyed. Quaintance and Brues,[2] in making up their estimate of the damage done by this insect to the corn crop of the country, showed that counts made at Paris, Tex., gave an average destruction of 15 per cent of the grains. The corn ear-worm feeds so largely on the small grains at the tip of the ear that the destruction of 10 per cent of the kernels does not represent 10 per cent of the corn produced by the ear. The kernels destroyed do not average less than three-fourths the size of the others, and it would therefore be conservative to say that the insect destroys 7.5 per cent of the total amount of corn which would otherwise have been produced by infested ears. This means that our corn crops of the last two years, enormous as is their total value, have brought us about five and one-half million dollars less than they would have had the corn ear-worm damage been eliminated. Nor is this all the harm it has wrought. By piercing the husk it opens the way to the entrance of various molds and bacteria, and its excrement forms a medium on which certain species of molds and bacteria, particularly dangerous to horses, grow and develop. Feeding tests, as yet unpublished, conducted by our veterinary department, have indicated that certain species commonly found in "worm dust" will produce in horses well-marked cases of blind staggers.

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[1] A more complete treatment of the corn ear-worm's work in Kansas will be given in a forthcoming bulletin.

[2] Bulletin No. 50, Bu. of Ent., U. S. Dept. of Agr., p. 22.

In this pest, then, we have a creature that not only destroys our corn crop directly, but indirectly threatens the lives of some of our valuable domestic animals. Anything practical which will materially reduce the work of this creature is worthy of the farmer's attention. Although our study has not proceeded far enough to show how the individual farmer may, independently of his neighbors, eliminate its work from his crop, it has proceeded far enough to show how at least 40 per cent of the injury may be avoided, and experiments showing how this may be done have been thought worthy of presenting to the farmers of our state.

LIFE HISTORY AND HABITS.

Where it is Now. The corn ear-worm is now in the soil of corn fields infested with the larvæ last summer. It has been there since last fall and will be there until next June. It averages about three inches below the surface of the soil. At present it is in the form of an oval light shining brown object (pupa) which is unable to move any part of the body except the tail. The larva entered the soil last fall and burrowed downward for several inches. It then excavated a tunnel from this point upward toward the surface, leaving a thin plate of surface soil untouched. It then returned to the bottom of the burrow, shed its skin and came forth as a helpless pupa.

What it will do Next Spring. In late May and in June this pupa and others like it will split open at the head end, and from each a curious looking creature will emerge. Each of these will crawl up its open burrow, burst the thin plate of soil and crawl out upon the surface. After a few hours the wings will have expanded and the body will have so dried and hardened that the moth will be able to take flight and begin its serious business of securing food and reproducing its kind.

First Brood. In 1908 the moths began to emerge from indoor cages May 17, ceased June 22, and the majority were out by June 6. In 1909 from twenty-five pupæ placed in an unheated room indoors the first moth emerged May 29, the last July 3, and the majority had emerged by June 7. From twenty-five pupæ placed in soil out of doors, the first moth came June 9, the last June 26, and the majority had emerged by June 22. The females deposit their eggs upon many sorts of useful plants and upon weeds, but evidently prefer corn. They place the eggs on the young corn leaves, and the larvæ, which hatch in four or five days, make their way into the tender curl and feed there. In a little over eighteen days the larvæ become fully grown and enter the soil. In about thirteen days more the adult moths come out of the soil and the second brood begins its work.

Second Brood. The second brood of moths begins to fly in early July, and the larvæ to which its eggs give rise feed upon the corn plant during the latter part of July and the first half of August. The later members of the second brood of moths have opportunity to deposit their eggs on the corn silks. Some of the second brood larvæ are therefore raised upon a diet of tender corn silk and grains. The moths of the corn ear-worm, regardless of brood, will, if the opportunity offers, lay their eggs almost exclusively upon tender corn silks.

Third Brood. By the 21st of August some of the second brood larvæ have become fully grown and transformed to pupæ from which the moths are ready to emerge. The third brood of moths begin to fly in the latter part of August and deposit their eggs upon tender corn silks. The larvæ which hatch from these eggs consume the silks and penetrate beneath the husks of the forming ear, where they feed upon the juicy grains. Those members of the third brood which emerge after the corn silks are dried and shriveled betake themselves to weed patches and alfalfa fields and deposit their eggs upon various weeds and alfalfa. Many of the third brood larvæ which during their early life were nourished upon a diet of corn are compelled to finish their growth upon a diet of weeds.

Partial Fourth Brood. By October 13 some of the larvæ produced by the earliest of the third brood moths have reached maturity, entered the soil, transformed to pupæ, which are ready to give up adult moths. These moths emerge as members of the partial fourth brood. Larvæ produced by the partial brood probably never reach maturity and perish in the oncoming cold weather. Most of the third brood pupæ do not produce adults in the fall, but remain in the soil during the winter.

Summary. In Kansas the corn ear-worm experiences three full broods and one partial. The larvæ of the first three feed mainly upon the corn and the latter part of the third and all of the fourth feed upon various weeds and alfalfa.

METHODS OF CONTROL.

Destruction of overwintering pupæ.

The fact that the corn ear-worm larva can and does feed on garden truck, weeds and alfalfa would lead one to suppose that it passes the winter in the soil where these grow as well as in that of infested corn fields. But the experiments of the last two years indicate that practically none of the pupæ winter in the soil of weed patches and alfalfa fields about Manhattan. Gardens are small and therefore of so little consequence in the propagation of this insect as a field-corn pest that they have not been examined. Our present data clearly indicate that the mass of pupæ, from which will come the damaging broods the following summer, winter in the soil of infested corn fields.

It has long been known that late fall or early winter plowing of infested land would, by exposing the helpless pupæ to the attacks of their enemies and to the effects of the weather, destroy a large percentage of them. Experiments at Manhattan during the winter of 1908 showed that plowing infested corn fields five or six inches deep in late fall and early winter destroyed practically 100 per cent of the overwintering pupæ.

The corn ear-worm moth is a strong flyer and readily passes from unsatisfactory fields into those more to its liking. Our observations indicate that locating the prospective corn field as great a distance as Kansas farm conditions permit from land known to be infested will not go far toward producing a clean crop. In fact, it seems that the moths will travel considerable distances in search of corn in a stage of development suitable to their needs. This is particularly true when the plants are in "silk."

The facts recorded in the three preceding paragraphs clearly indicate that late fall or early winter plowing of *all* the infested corn fields in a community would greatly reduce the corn ear-worm's damage the following summer, but that if only one grower thus treated his land the moths emerging from his neighbors' fields would so infest his corn that he would experience a greatly reduced benefit.

Time of Planting.

Observation of actual field conditions in the country about Manhattan during the fall of 1908 clearly showed: (1) That, other things being equal, late planted corn suffered more severely than that which was planted early; (2) that this difference was due to the fact that late planted corn was in its most attractive stage (in "silk") during the time the third and largest brood of moths was on the wing, while the early planted corn had finished "silking" by the time the mass of this brood was ready to emerge. To determine the extent to which time of planting on uninfested land would enable the individual grower working independently of his neighbors to reduce the corn ear-worm's damage he would normally suffer, we selected two and one-half acres of land which was located near fields in corn the previous year but which had itself been lying idle for one season, and divided it into six plots of equal size. In each plot three 150-feet long rows of each of the following six standard varieties of corn were planted: Leaming (115-day corn), Reid's Yellow Dent (115-day corn), Boone County White (115-day corn), McAuley (120-day corn), Kansas Sunflower (125-day corn), and Hildreth (135-day corn). Plot No. 1 was planted April 15, plot No. 2 May 1, plot No. 3 May 15, plot No. 4 June 1, plot No. 5 June 15, and plot No. 6 July 1. Plot No. 1 received a "set-back" from cold weather. Plots No. 1 and No. 2 suffered from wind and hail. Plots No. 4 and No. 5 were injured and plot No. 6 ruined by the late dry weather. Plot No. 1 produced 39.8 bushels per acre, plot No. 2 46.5 bushels, plot No. 3 49.7 bushels, plot No. 4 46.7 bushels, plot No. 5 26.1 bushels, and plot No. 6 almost nothing.

Plot No. 2, planted May 1, showed 36.2 per cent of its ears free from infestation. This was 6.1 per cent more than that shown by plot No. 1, 14.6 per cent more than plot No. 3, 30.5 per cent more than plot No. 4, 35.8 per cent more than plot No. 5, and 36.2 per cent more than plot No. 6. Furthermore, of the ears infested plot No. 2 lost 1.2 per cent less grains per ear than plots No. 1 and No. 3, and 3.1 per cent less than plot No. 4. It is clear that in this experiment corn planted May 1 experienced about 40 per cent less damage than corn planted June 15 or later, 33 to 35 per cent less than that planted June 1, and 16 to 20 per cent less than that planted May 15.

While the variety of corn which requires the least time to mature shows the smallest amount of injury, the difference is so small as hardly to be worth considering.

Whether the individual farmer, who plants his corn upon uninfested or cleaned land (land in which the overwintering pupæ have been destroyed by late fall or early winter plowing), will obtain equal or better or worse results than those just recorded depends on the amount of infested corn land near his crop and the extent to which his neighbors follow his example.

Recommendations.

1. Plant the crop on uninfested or cleaned land.
2. Plant the crop just as early as is possible and escape "set-back" from cold weather.
3. Plant the standard variety that yields best in your locality.

Fortunately, these are measures that make for the production of maximum yields anyway and should be adopted were there no such pest as corn ear-worm.

KANSAS STATE AGRICULTURAL COLLEGE
EXPERIMENT STATION.—CIRCULAR NO. 8.

DEPARTMENT OF AGRONOMY
A. M. TENEYCK, AGRONOMIST IN CHARGE.

Investigation of the Vitality of Kansas Seed-Corn.*

BY

A. M. TENEYCK,

Corn was severely injured last season by the drought and hot weather in August, which resulted in the production of many light and chaffy ears. Again, the winter set in a month earlier than usual and the early snow and severe cold weather found the larger part of our Kansas corn crop still in the field unhusked, and many farmers failed even to gather seed-corn before the freeze-up. Because of these unfavorable conditions those who were best acquainted with the situation feared that much of the seed-corn was injured in vitality and that there was likely to be a shortage of good seed-corn for planting in this State.

In order to determine the actual condition of the seed-corn, the writer issued a general invitation to the farmers to send samples of the corn which they intended to use for seed to the Agronomy Department of the Experiment Station for testing. This invitation, with a circular giving directions for sampling, etc., was sent to a number of corn growers. The announcement was also published widely through the newspapers and the agricultural press of the State.

The instructions given for sampling were as follows: "Select twenty-five good ears from the seed-corn you have saved or from the crib or field—such ears as you would choose for planting. Select six kernels from each ear, two from near the tip, two from near the middle, and two from near the butt of the ear, removing duplicate kernels from opposite sides of the ear. This ought to give an average sample fairly representing your seed-corn. Place the kernels in a seed envelope with note giving your name and address, name of variety, and a careful description of the condition under which the seed-corn was gathered and stored, and mail to the Agronomy Department of the Kansas State Agricultural College."

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*This work has been in charge of Mr. Joe Lill, one of our graduate students, who has carried out all of the germination work and has made the computations from which the data and conclusions published in this circular have been determined.

This announcement was first published about the middle of February. The testing of samples was begun the last week in February and has continued to this date (March 15). Nearly 300 samples have been received, and this report includes 250 tests which have been completed. Fifty-seven counties are represented by the tests included in this report. The places from which samples were received were well distributed over the middle and eastern sections of the State, but only a few samples came from the western third of the State.

Several of the parties who sent in samples failed to carry out the instructions fully regarding sampling, and sent smaller samples than required. When possible these were duplicated. A number failed to send descriptive data and a few neglected to write their name and address. A personal letter reporting the result of each germination test was sent to the grower of the corn with advice and directions regarding the planting or further testing of such seed-corn.

The time allowed for the germination of the samples was about six days. The kernels were examined and counted when the rootlets were about two inches in length, and only the grains that showed healthy, normal rootlets were counted as germinated.

The following is some of the general data secured by this investigation:

The average germination of the seed-corn of Kansas as determined by this investigation is 92.25 per cent; that is, 92 kernels out of every 100 kernels tested sprouted.

COMPARING EARLY AND LATE GATHERED SEED-CORN.

One hundred twenty-five samples of corn gathered early, before December 1st, gave an average germination of 95.18 per cent.

Fifty-four samples of corn gathered late, after December 1st, gave an average germination of 88.54 per cent.

COMPARING THE SEED-CORN GATHERED EARLY AND WELL CARED FOR WITH CORN HUSKED EARLY AND THROWN IN THE CRIB, FROM WHICH THE SEED EARS WERE LATER SELECTED.

Eighty samples of seed-corn gathered early and well saved gave an average germination of 97.7 per cent.

Nine samples of corn husked early, but seed taken from the crib, gave a germination of 93.3 per cent.

COMPARING SEED-CORN GATHERED LATE FROM THE SHOCK WITH THAT TAKEN IN THE WINTER FROM THE STANDING STALKS IN THE FIELD.

Thirty-six samples gathered from the field after December 1st gave an average germination of 87.7 per cent.

Six samples taken from the shock after December 1st gave an average germination of 86.6 per cent.

COMPARING THE GERMINATION OF VARIETIES.

Fifteen samples of Reid's Yellow Dent corn gave an average germination of 98.8 per cent.

Twenty-eight samples of Kansas Sunflower corn gave an average germination of 95.94 per cent.

Forty-nine samples of Boone County White corn gave an average germination of 94.52 per cent.

Twenty-three samples of Hildreth corn gave an average germination of 92.38 per cent.

Eleven samples of Silvermine corn gave an average germination of 86.85 per cent.

The average germination of 123 other varieties was 91.47 per cent.

COMPARING THE GERMINATION ACCORDING TO THE EARLY OR LATE MATURING CHARACTER OF THE CORN.

Sixteen samples of fairly early maturing corn such as the Silvermine gave an average germination of 89.03 per cent.

Sixty-six samples of medium early maturing corn, such as Boone County White and Reid's Yellow Dent, gave an average germination of 95.11 per cent.

Thirty-two samples of corn of medium maturing season, such as Kansas Sunflower and McAuley's White Dent, gave an average germination of 95.6 per cent.

Thirty-two samples of late-maturing corn, such as Hildreth and Hiawatha Yellow Dent, gave an average germination of 92.79 per cent.

COMPARISON OF GERMINATION OF SAMPLES BY DISTRICTS.

Southeastern district, including counties of Chautauqua, Montgomery, Labette, Cherokee, Wilson, Bourbon, Allen, and Linn, 17 samples gave an average germination of 95.75 per cent. Of this lot, 9 samples gathered early averaged 96.71 per cent, and 4 samples gathered late averaged 91.16 per cent.

Southern district, including counties of Butler, Cowley, Sumner, Harper, Kingman, Sedgwick, Harvey, Reno, Clark, Stafford, Pawnee, Rice, Barton, and Rush, 54 samples gave an average germination of 93.21 per cent; 27 samples of early-gathered corn averaged 94.58 per cent, and 8 samples of late-gathered corn averaged 98.53 per cent.

Northern district, including counties of Dickinson, Saline, Ottawa, Clay, Washington, Republic, Cloud, Mitchell, Jewell, Smith, Osborne, and Rooks, 50 samples gave an average germination of 88.78 per cent; 22 samples of early-gathered corn averaged 92.22 per cent, and 16 samples of late-gathered corn averaged 81.44 per cent.

Northeastern district, including counties of Johnson, Franklin, Osage, Lyon, Morris, Wabaunsee, Douglas, Shawnee, Jefferson, Leavenworth, Doniphan, Atchison, Jackson, Marshall, Pottawatomie, Riley, and Geary, 112 samples gave an average germination of 92.5 per cent; 63 samples of early-gathered corn averaged 95.46 per cent, and 33 samples of late-gathered corn averaged 88.87 per cent.

Of the 250 samples tested, 190 samples gave a germination above 90 per cent; of these, 127 samples tested 95 per cent, or better, and 25 samples gave a perfect germination. Only 60 samples out of the 250 tested below 90 per cent, 20 samples tested below 80 per cent, 9 samples tested below 70 per cent, and 3 samples tested below 50 per cent, the lowest germination being 30 per cent.

GENERAL CONCLUSIONS.

1. The average germination of Kansas seed-corn is high.
2. The germination of the early-gathered corn is, on the average, nearly 7 per cent better than the germination of the late-gathered corn.
3. The germination varies in the different districts, being lowest in the northern districts, but the early-gathered corn shows good vitality in each district.
4. Medium or medium early maturing varieties gave a higher germination than the early or very late maturing varieties.
5. There was little difference in vitality of seed-corn gathered late from the standing stalk or from the shock.
6. The early-gathered and well-saved seed-corn germinated 4.5 per cent better than the corn husked early and stored in cribs, and over 9 per cent better than the late-gathered seed-corn.

Approved:

ED. H. WEBSTER, *Director*.

MANHATTAN, KAN., March 22, 1910.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 9.

DEPARTMENT OF VETERINARY SCIENCE.

F. S. SCHOENLEBER, Veterinarian in Charge.

RABIES—HYDROPHOBIA.

BY

L. W. GOSS,

Assistant in Veterinary Investigations.

RABIES—HYDROPHOBIA.

During the past year there have been many cases of rabies in Kansas, which have caused much loss of live stock, mostly cattle, hogs and horses, and in several localities people have been bitten by rabid dogs.

This is one of the oldest diseases known. In the fourth century B. C. it was described by Aristotle, who wrote: "Dogs suffer from a madness which puts them in a state of fury, and all the animals that they bite when in this condition become also attacked by rabies."

The season of the year makes very little difference, as the disease is just as prevalent in winter as it is in summer. This seems contrary to the ideas of many persons, who think that July and August, "dog days," is the only time that dogs are subject to rabies.

CAUSE. Rabies is caused in nearly all cases by the bite of a rabid animal. It is possible to contract the disease from the saliva, the tears from the eyes or the milk of a rabid animal. The rabid dog is a source of danger a few days before the symptoms of the disease appear, but in no case before he was bitten by a rabid animal, or otherwise inoculated. Hot weather, lack of water or ill treatment will never in themselves produce rabies.

The dog is the principal source by which rabies is spread over the country. The freedom which he is given, his natural manner of self-protection, and his tendency to roam about bring him in contact with many other animals. Cats, hogs, horses and cattle, in the order named, are less dangerous than the dog.

SYMPTOMS. The symptoms seldom develop in less than fourteen days after the animal was bitten—most commonly three to six weeks—but they may not show for six months to a year. Not all animals bitten develop the disease. It depends some upon the part of the body which was bitten. In man there is less danger if bitten through the clothing than upon the bare parts of the body, as the hands or face, the latter place being the most dangerous. It is not uncommon for the symptoms to develop in less than two weeks when bitten upon the head.

The symptoms show in one of two forms—furious or dumb.

FURIOUS RABIES. With the furious form the dog is at first noticed to seek the company of his master more than usual, or he will hunt dark, secluded places. Sometimes he will make sudden starts toward objects. These conditions last for a day or two. Later he becomes more restless, wanders about, and will often travel twenty to thirty miles in a day. While he is on this trip he is very likely to bite cattle, hogs and strange dogs, often passing horse and man, unless they interfere with his course. He will usually return home unless he is killed. During this period he is irritable, seldom eating or drinking, not because he does not want food or water, nor because he is afraid of water, for he is not, but from the fact that his throat is paralyzed and he cannot swallow. Often he will force sticks and stones down his throat in efforts to satisfy hunger and thirst. This period of irritation lasts for two or three days, followed by a period of paralysis, which has already taken place in the throat, as shown by the voice, which has already changed to a prolonged howl, and the inability to swallow. This is followed by paralysis of the hind legs, and later by entire paralysis and death, the entire symptoms lasting from four to ten days.

DUMB RABIES. The dog seeks his master's company or may hide in dark places, becomes unable to eat or drink, the lower jaw hangs down and tongue protudes, which may swell and turn dark. This condition is followed by paralysis and death in four to ten days after the first symptoms appear. Either form of the disease may change to the other in the same animal.

SYMPTOMS. *In Cattle.* They are prone to chase chickens, dogs, and may run at man, whom they are less apt to attack. Often falling down from no apparent cause, twitching of muscles, inability to eat, due to paralysis, often showing signs of sexual excitement even when pregnancy is well advanced, but seldom biting. These symptoms are followed by paralysis and death.

The Horse. Is often more vicious than cattle, biting the manger, himself, or anything within reach; also showing many of the same symptoms which are shown by cattle.

The symptoms of rabies vary greatly, but in general there is a first stage of melancholia lasting two or three days, followed by a period of excitement which lasts two to three days more, followed by a period of paralysis. Death usually occurs inside of ten days after the first symptoms appear.

DIAGNOSIS. This is made from microscopic examination of the brain, which shows small round or oval bodies from 1/25000 to 1/1000 of an inch in diameter. These are called Negri bodies, as they were first noticed by a man by the name of Negri in 1903. They have never been found in the brain of an animal unless the animal had been inoculated with rabies virus; therefore when Negri bodies are found in the brain of an animal there is no doubt that the animal had rabies.

There are also changes in the nervous ganglia in the last stages of rabies. These changes are also found in other diseases, which makes this manner of diagnosis more uncertain and of little use in the early stages of the disease. Sticks and stones may be found in the stomach of a rabid dog.

TREATMENT. This consists of a preventative treatment (Pasteur), which must be taken before the symptoms have developed. In order to be effective it should be taken within a few days after having been bitten by a rabid animal. The treatment may also be given to valuable domestic animals. The "mad stone" is of no use as a prevention of rabies.

INSTRUCTIONS FOR SHIPPING. When it is of importance to know if a suspected animal had rabies an examination of the brain will be made if it is sent to the Veterinary Department and arrives in good condition and all express charges are prepaid.

In preparing for shipment the head should be removed as soon after death as possible and wrapped in a cloth which is saturated with ten-per-cent formaline, placed in a tin box, and sealed. During warm weather the can should be placed in a box of ice. It should be shipped by express, charges prepaid, with a letter of explanation, addressed to the Veterinary Department of the Kansas State Agricultural College, at Manhattan.

Approved:
ED. H. WEBSTER, *Director*.

MANHATTAN, KANSAS, July 9, 1910.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 10.

DIVISION OF FORESTRY.
CHAS. A. SCOTT, Forester in Charge.

Provisions of the State Forest Law.

BY
CHAS. A. SCOTT.

THE NEW FORESTRY LAW.

The recognized need of a vigorous forestry policy and an aggressive campaign for tree planting on every farm in Kansas prompted the legislature of 1909 to pass the following forestry bill, which was signed by Governor Stubbs on March 8 and became effective on March 15, 1909:

SENATE BILL No. 231.

AN ACT to establish at the Kansas State Agricultural College a division of forestry under the direction of the board of regents of that institution, and appropriating funds for the support of same, and repealing chapter 405 of the Session Laws of 1907.

Be it enacted by the Legislature of the State of Kansas:

SECTION 1. For the promotion of forestry in Kansas there shall be established at the Kansas State Agricultural College, under the direction of the board of regents, a division of forestry. The board of regents of the Kansas State Agricultural College shall appoint a state forester who shall have general supervision of all experimental and demonstration work in forestry conducted by the Experiment Station. He shall promote practical forestry in every possible way, compile and disseminate information relative to forestry, and publish the results of such work through bulletins, press notices, and in such other ways as may be most practicable to reach the public, and by lecturing before farmers' institutes, associations and other organizations interested in forestry.

SEC. 2. The state forester shall employ, under the direction of the board of regents of the Kansas State Agricultural College, such assistants, who shall be practical foresters, laborers and clerks, and shall purchase necessary office furniture and equipment as may be needed to carry into effect the purposes of this act.

SEC. 3. The state forester shall, upon request, coöperate with towns, counties, corporations and individuals in preparing planting plans and plans for the protection, management and replacement of trees, wood lots and timber tracts under an agreement that the persons obtaining such assistance shall pay the field expenses of such work.

SEC. 4. The board of regents of the State Agricultural College may also conduct on the Dodge City and Ogallah Stations other demonstrations and experiments of local interest, such as seed breeding and tillage experiments, whenever such demonstrations may not interfere with the work in forestry.

SEC. 5. For carrying the provisions of this act into effect there shall be appropriated from moneys in the state treasury, not otherwise appropriated, the sum of one thousand dollars for the fiscal year ending June 30, 1909; two thousand dollars for the fiscal year ending June 30, 1910, and two thousand dollars for the fiscal year ending June 30, 1911. All vouchers for salaries and other expenses shall be paid in the same manner as expenses of the Kansas State Agricultural College.

SEC. 6. The Forestry Stations at Ogallah and Dodge City shall remain the property of the state for the purpose of conducting experimental and demonstration work in forestry under the direction of the board of regents of the State Agricultural College, who shall have all power in relation thereto now exercised by the Executive Council. And for the purpose of maintaining said Stations and for the purchase of trees, plants, seeds and cuttings, and for the payment of other incidental expenses, there is hereby appropriated the following sum, or as much as may be necessary, to wit:

For the Station at Ogallah.

For the fiscal years ending June 30, 1910, and June 30, 1911:

	1910	*1911*
Maintenance and repairs	$500	$500
For the purchase of trees, seeds and cuttings	300	300
For labor	1,200	1,200
For postage, freight and incidentals	200	200
	$2,200	$2,200

For the Station at Dodge City.

For the fiscal years ending June 30, 1909, June 30, 1910, and June 30, 1911:

	1910	*1911*
Maintenance and repairs	$500	$500
For the purchase of trees, seeds and cuttings	300	300
For labor	1,200	1,200
For postage, freight and incidentals	200	200
	$2,200	$2,200

For the Dodge City Station $500, or as much thereof as may be necessary, for the purchase of a team, said sum to be available at once.

SEC. 7. Chapter 405, Session Laws of 1907, and all acts and parts of acts conflicting with this are hereby repealed.

SEC. 8. This act shall take effect and be in force from and after its publication in the official state paper.

I hereby certify that the above bill originated in the Senate, and passed that body February 27, 1909.

W. J. FITZGERALD,
President of the Senate.
Z. E. WYANT,
Secretary of the Senate.

Passed the House March 8, 1909.
J. N. DOLLEY,
Speaker of the House.
C. H. BRILHART,
Asst. Chief Clerk of the House.
Approved March 12, 1909.—W. R. STUBBS, Governor.

STATE OF KANSAS,
OFFICE OF THE SECRETARY OF STATE.

I, C. E. Denton, secretary of state of the state of Kansas, do hereby certify that the above and foregoing is a correct copy of the original enrolled bill now on file in my office.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed my official seal, this 13th day of March, 1909.

[SEAL.] C. E. DENTON,
Secretary of State.

In accordance with the foregoing provisions of the act of the state legislature, the state forester will gladly give all possible assistance to those desiring his services. We are especially anxious to get in touch with all who intend to plant shelter belts and groves of forest trees, and when warranted in doing so we will prepare planting plans for such work. Special attention is given to the preparation of planting plans for city and town parks, court house and school yard plantings. This work is in charge of an expert landscape gardener.

The only charge made for services from this office is the actual expense incurred by the work, such as car fare, board and lodgings, and incidental expenses.

Section 3 of the above act specifies that the person for whom such work is done must bear the expense. The amount of such expenses will depend entirely upon the distance the work is located from Manhattan or Hays, Kan. Whenever convenient two or more projects will be handled on one trip and the expenses prorated.

Applications for assistance should be made direct to the State Forester, Manhattan, Kan., and all applications should be made as early as possible, so that the plans can be prepared and returned in time to allow orders for planting stock to be made by January 1.

On account of the work at the Dodge City, Ogallah and

Hays Stations demanding our attention during the spring months, we cannot prepare planting plans during the months of April, May and June.

Approved:
ED. H. WEBSTER, *Director.*

MANHATTAN, KAN., July 21, 1910.

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Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 11.

DEPARTMENT OF AGRONOMY.

W. M. JARDINE, Agronomist in Charge.

*The Relation of Size, Weight and Density of Kernel to Germination of Wheat.**

BY

J. G. LILL.

This investigation was carried on during the fall of 1909 at the Kansas State Agricultural College as a part of the work required of graduate students in agronomy.

The object of this experiment was to determine the difference, if any, in the vitality or germination of large and small, and heavy and light, kernels.

Standard varieties of winter wheat, Turkey and Kharkof usually, were used in this investigation, being wheat grown on the Agricultural College farm in 1909.

The experiment was conducted along four general lines, namely:

1. Kernels separated by weight.
2. Kernels separated by size.
3. Kernels separated by density.
4. Kernels separated by size and density.

In this investigation a germinating bed of new style was used. The bed consisted of wood fiber plates. These took up water like a sponge and held enough so that water could be squeezed out of them after the tests. The following is the way the bed was operated: The plates were moistened and the sample or part of the sample placed in a plate. These kernels were then covered with a piece of damp paper, and the next plate, which had been treated in the same manner, placed on it. Fifty or more plates could be placed in a stack, which would hold between 1200 and 2500 kernels. The germinating bed or stack was then placed in a booth that could be closed. A gas burner was placed in the booth to keep the temperature constant. A pan of water placed above the flame kept the air saturated and prevented evaporation from the plates. The principal reasons for the use of a bed of this description were: Great economy of space, cheapness and lightness of material, ability to control conditions and subject comparative samples to the same conditions.

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* The accompanying paper reports the results of an experiment conducted by J. G. Lill in the fall of 1909, as a part of the work required of graduate students in agronomy at the Kansas State Agricultural College. The object of the investigation, as the author points out, was to determine the relation of the size, weight and density of the kernel to the germination of wheat. It is a question concerning which considerable diversity of opinion obtains. The results of this experiment are considered to be sufficiently comprehensive to warrant their publication at this time.

W. M. JARDINE, *Professor of Agronomy.*

The only fault that has been found with the bed, and it is apt to occur in any germinator, is that certain fungi grow in the wood fiber from which the plates are made and this necessitates frequent sterilization of the plates.

The conditions for the germination of the wheat, throughout the experiment were kept at about the optimum. The temperature was kept at about twenty degrees centigrade, although twice it fell to about ten degrees, due to the failure of the gas supply. Although the conditions varied to some extent for the different series of tests, the conditions for the germination of comparative samples were almost the same, as the samples were placed in the same stack and usually in adjacent plates.

The usual time required for the germination of the samples was four days, though when the temperature fell the time was lengthened to six days.

In all tests complete records were kept of average weights, germination, and numbers of kernels used, but where these data were too bulky for good presentation only the averages or condensed tables are given, as in test No. 1. The average weight and number of kernels in each head were recorded but only the average germination and total numbers of kernels are given.

The results of the different tests are given as follows:

TEST No. I.

Comparing the germination of the heavier and lighter kernels in the same head.

In this test heads of wheat were used which were selected by the Agronomy Department for breeding experiments.

Each head was separated into two samples of kernels, one heavier and one lighter than the average weight of all the kernels in the head. This separation of samples necessitated a large amount of weighing, as the total number of kernels in each head was weighed first in bulk, then separately as the average weight per kernel was determined and the weight of each compared with the average weight of the kernels in that head. On account of the time taken in weighing the kernels only 246 heads were used, including 7679 kernels. The scales used were the Agronomy Department analytical balances, Eimer & Amend No. 12,969, weighing to 0.0001 of a gram. The summary of this test is shown in the following table:

Grade.	No. of kernels tested.	No. of kernels germinated.	Percentage of germination.
Heavier than average	4,707	4,684	98.74
Lighter than average	2,972	2,877	96.80
Total	7,679	7,525	97.99

This summary indicates, first, that a difference of over one per cent exists between the germination of the heavier and the lighter kernels of the head, in favor of the heavier; second, that the heavier kernels do not exceed the average as much as the lighter kernels drop below it. For example, the germination of the kernels heavier than the average exceeds the average germination by 0.75 per cent, while the germination of the kernels lighter than the average falls below the average germination 1.19 per cent.

The original data recorded indicated that the average weight of the kernels of the head does not affect the germination; that is, there is no constant difference in the germination of kernels from heads with only large or only small kernels. The chances for error in this test were slight but constant. Some of the samples were infected by grain moth but the injured kernels were discarded. The number of kernels used in this test minimizes the probability of error and serves to make more accurate the results of the test.

TEST No. II.

A comparison of the germination of the larger and the smaller kernels as separated by graduated sieves.

Two samples of wheat were secured in the grain laboratory and sieved or screened into five grades, thus grading the wheat entirely according to size. The sizes of the screens and grades were as follows:

Grade 1, kernels which would not pass through a 2.50 mm. mesh. Average weight of several of the samples of this grade, 0.0368 grams.

Grade 2, kernels which would pass through a 2.50 mm. mesh but would not pass through a 2.25 mesh. Average weight for this grade, 0.0332 grams.

Grade 3, kernels which would pass through a 2.25 mm. mesh but would not pass through a 2.00 mm. mesh. Average weight for this grade, 0.0310 grams.

Grade 4, kernels which would pass through a 2.00 mm. mesh but would not pass through the tailings screen of unknown measure. Average weight for this grade, 0.0246 grams.

Grade 5, kernels which would pass through the tailings screen of unknown measure. Average weight for this grade, 0.0172 grams.

The object of this test was to determine the difference, if any, between the germination of the different grades or sizes.

Duplicate tests were made, using about 400 kernels to the sample of each grade. The following table gives the results in percentages of the germination of each grade.

Table giving the germination of the grades of wheat where the grain was graded entirely by size:

GRADE.	Per cent of germination.				Size in mm.	Av. wt. in grams.
	Sample No. 1.	Sample No. 2.	Sample No. 1.	Sample No. 2.		
Grade 1....	93.0	99.0	94.0	95.8	Above 2.50.	0.0368
Grade 2....	89.0	96.0	92.0	95.3	From 2.50 to 2.25.	0.0332
Grade 3....	88.0	98.0	91.0	96.8	From 2.25 to 2.00.	0.0310
Grade 4....	90.0	95.0	93.5	96.3	From 2.00.	0.0246
Grade 5....	86.0	96.0	89.1	93.3	Below grade 4.	0.0172

The results of this test indicate that, first, there is a slight difference between the germination of the larger and smaller kernels as separated by sieves, but that this difference is not constant; second, the largest kernels do not always germinate the best; and third, the smallest kernels usually, although not always, germinate the poorest.

TEST No. III.

The comparison of the germination of kernels of different densities.

The object of this test was to determine, if possible, the relation between the density and the germination of the kernel.

By the term "density," as here used, is meant the specific density of the kernel, its weight in proportion to its size, or weight per unit volume.

The separation of the wheat according to the density of the kernels was accomplished with a wind-blast grader—the theory being, and later by actual tests was proven to be a fact, that kernels of greater density would fall first, while kernels of lesser density would be carried farther in proportion to their density, so that by catching the falling kernels in divisions or boxes placed at certain distances from the blast they would be graded according to density, with the first grade nearest the blast.

The graders used in this test were of two kinds. The first one was a long tin tube from which the kernels were blown and allowed to fall into boxes placed at certain distances on the floor. The second was a deep, narrow channel between two pieces of tin, closed except at the extreme end, so that the kernels were affected by the same blast all through the grader. The bottom of this grader was divided into six divisions that could be opened for the removal of the kernels that fell into them. Both blasts were run by a motor and a centrifugal fan. The motor was so arranged that the speed was constant.

This experiment was carried on with seven different samples of unsieved wheat, including several varieties. The following table gives the summary of the tests. In this table each column of figures represents the germination of a separate original sample graded into six grades according to density, grade No. 1 being the most dense and grade No. 6 the least dense.

RESULTS OF BLAST GRADING.

GRADE.	Per cent of germination.							No. of kernels tested.	Av. wt. per kernel in grams.
	Sample No. 1.	Sample No. 2.	Sample No. 3.	Sample No. 4.	Sample No. 5.	Sample No. 6.	Sample No. 7.		
Grade 1	98.8	98.7	94.9	97.7	96.0	97.4	95.1	831	0.0328
Grade 2	93.6	98.0	95.8	97.8	98.5	95.4	93.5	2,000	0.0318
Grade 3	89 6	96.0	94.4	94.5	95.2	90.8	93.0	2,000	0.0293
Grade 4	86.6	96.0	92.0	92.7	95.4	100.0	90.5	1,000	0.0255
Grade 5	70.5	91.3	73.0	70.0	90.0	52.0	92.4	500	0.0200
Grade 6	....	....	....	51.9	81.0	....	56.2	200	....

This table indicates, first, that the kernels that fall first, or the kernels of greater densities, germinate best; second, that the germinating ability decreases as the kernels are carried farther or as the density lowers.

The chief source of error in this test is in only having a limited number of kernels in some of the samples, so that an accident or error would result in a large error in the results, and in having a small sample the class was not adequately represented as in sample 6, grade 4.

TEST No. IV.

A comparison of the germination of kernels of different densities and sizes.

This test was to determine the relation of the size and density to the vitality of the kernel.

The wheat used was sieved into five grades by means of the graduated sieves, and then each grade further separated according to density by the wind blast, thus dividing each original sample into about thirty smaller samples, each differing from the others in size or density. The usual size of the samples was 200 kernels, but the number sometimes fell below this because of the limited number of kernels available.

The results are given in the following tables. Each table represents a separate original sample taken at random. The vertical columns of figures in these tables give the germination of kernels of the same size, as separated by the sieves, but of different densities as determined by the blast. The horizontal lines give the germination of kernels of the same density, as separated by the blast, but of different sizes. In these tables the samples marked "No. 1," or the first grades, show the germination of the largest or the densest kernels while the grades marked "No. 6" or "No. 5" show the germination of the smallest or the least dense kernels. Thus, the upper left-hand figures in each table give the germination of the largest of the densest and the densest of the largest kernels, while the lower right-hand figures give the germination of the smallest of the least dense and the least dense of the smallest kernels. In these tables the average weight of the kernels of each sample is given just to the right of the figures giving the germination of the sample:

SAMPLE NO. I.

DENSITY.	Sieve grade Nos.									
	1		2		3		4		5	
	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.
Grade 1......	97.0	0.0376	100.0	0.0376	98.4	0.0318	100.0	0.0244	100.0	0.0190
Grade 2......	98.0	.0377	97.0	.0367	98.5	.0317	99.5	.0249	99.0	.0199
Grade 3......	93.0	.0339	90.0	.0342	94.5	.0306	98.0	.0236	96.0	.0187
Grade 4......	71.0	.0273	79.0	.0269	79.0	.0251	87.5	.0213	87.0	.0165
Grade 5......	52.0	.0213	56.0	.0206	58.0	.0171	68.0	.0148	74.0	.0124
Grade 6......	4.0	.0130	31.0	.0166	30.2	.0125	31.8	.0102	45.0	.0078

Vertical columns give germination of kernels of the same size.
Horizontal lines give germination of kernels of same density.

SAMPLE NO. II.

DENSITY.	Sieve grade Nos.									
	1		2		3		4		5	
	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.
Grade 1......	98.0	0.0400	100.0	0.0373	100.0	0.0366	100.0	0.0320	100.0	0.0207
Grade 2......	98.0	.0388	97.0	.0363	97.5	.0352	98.5	.0293	98.5	.0224
Grade 3......	88.0	.0376	94.5	.0328	95.0	.0336	96.5	.0270	94.5	.0197
Grade 4......	87.0	.0340	92.5	.0327	89.5	.0307	90.5	.0249	95.0	.0168
Grade 5......	66.6	.0316	78.7	.0294	78.1	.0300	85.7	.0213	88.5	.0136
Grade 6......	....	....	....	....	....	....	....	....	79.5	.0115

Vertical columns give germination of kernels of the same size.
Horizontal lines give germination of kernels of same density.

SAMPLE NO. III.

DENSITY.	Sieve grade Nos.									
	1		2		3		4		5	
	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.	Per cent of germ.	Wt. in grams.
Grade 1......	100.0	0.0339	97.9	0.0500	98.9	0.0341	98.8	0.0301	....	....
Grade 2......	97.5	.0382	96.5	.0354	98.5	.0358	96.5	.0271	99.5	0.0205
Grade 3......	97.0	.0341	95.0	.0311	95.5	.0277	94.5	.0242	95.5	.0151
Grade 4......	90.9	.0301	....	....	95.3	.0249	88.0	.0211	91.0	.0106
Grade 5......	....	....	....	....	....	....	....	....	73.9	....

Vertical columns give germination of kernels of the same size.
Horizontal lines give germination of kernels of same density.

CONSOLIDATED TABLE.

Giving the germination percentage of the density grades.

Density.	Per cent of germination.			Average per cent.
	Sample No. 1.	Sample No. 2.	Sample No. 3.	
Grade 1	99.08	99.6	98.9	99.19
Grade 2	98.40	97.9	97.7	98.00
Grade 3	94.30	95.7	95.5	95.16
Grade 4	80.70	90.9	91.3	87.63
Grade 5	61.60	76.6	73.9	71.70
Grade 6	28.40	79.5	....	53.95

These tables indicate that, first, the germination of wheat is dependent upon the density; second, the germination of wheat seems to be independent of the size of the kernel.

CONCLUSION.

The results of this investigation indicate that—

1. The heavier, better developed kernels in a head of wheat germinate better than the lighter kernels in the same head.
2. Grading according to size will not select the kernels which will germinate the best.
3. The germination is directly correlated with the density of the kernels.
4. The germination is independent of the size of the kernels.

The above points have been indicated by the results of the tests. It is believed that the samples used were large enough to give accurate determinations of the germinating ability of the different samples of wheat.

Approved:
ED. H. WEBSTER, *Director*.

MANHATTAN, KAN, Sept. 1, 1910.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 12.

DIVISION OF BOTANY.
H. F. ROBERTS, Botanist in Charge.

Treatment of Seed Wheat for Smut.

BY

H. F. ROBERTS, In Charge.
PAUL W. GRAFF, Assistant in Plant Pathology.

Wheat is infected by two kinds of smut, known respectively as the "loose smut" and the "stinking smut," or "bunt." In the case of the latter, particularly, the smut may be controlled by the treatment of the seed wheat. The best treatment for the prevention of stinking smut is by what is known as the formaldehyde method, as follows: Mix one pound (= 1 pint) of commercial 40 per cent formaldehyde with 50 gallons of water. *This solution should not be made up until needed for use*, as it loses strength by standing. Spread the seed wheat out on a clean barn or granary floor and sprinkle with the formaldehyde solution, shovelling the grain over and over until each grain is thoroughly moistened. An ordinary garden watering can can be used in sprinkling, but a three- or four-gallon hand sprayer, such as is used for spraying fruit trees, is even better. When thoroughly moistened, the grain should be shovelled into a heap and covered with a canvas or tarpaulin for two or three hours. The floor on which the work is done should first be sterilized by washing down with the solution of formaldehyde. The method just described will kill the spores or reproductive bodies of the stinking smut, which fill the swollen, blackened, smutted kernels, and which are scattered over the grain in handling and storage by the breaking up of these kernels in the separator. (Note: Commercial 40 per cent formaldehyde sells at about fifty cents a pound (pint) retail, thirty-five cents a pound wholesale, and can be obtained at any retail drug store, either directly or by order on a wholesale house.)

The loose smut fungus develops within the kernel, through infection from smutted heads at flowering time, when the spores are blown from plant to plant by the wind. Unlike the stinking smut, the newly infected kernels do not reveal the presence of the smut within. For the destruction of the loose smut in infected grain, another method is used as follows, known as the Jensen hot water treatment: The seed wheat should be placed, in quantities not to exceed one-half peck each, in loose burlap bags and soaked for five or six hours in water at a temperature of from 63 to 72 degrees Fahrenheit. For this purpose a 50-gallon coal oil barrel is convenient, the sack of grain being hung from a stick laid across the top of the barrel. Meanwhile water should be heated in quantity sufficient to fill two additional barrels with from 20 to 40 gallons of hot water, according to the quantity of seed to be treated. The water for these two barrels should be gotten to a temperature of 129 degrees Fahrenheit. This may be done in one of two ways; first, by heating the water several degrees above this point, pouring it into the barrels, and then testing from time to time by means of a good thermometer hung deep in the water, until it registers 129 degrees. When the water in the two barrels is at the required temperature, the sack of soaked grain from the cold water barrel is immersed for one minute in one of the hot water barrels (which should be marked No. 1) to bring the temperature of the grain up to the required temperature. The sack should then be transferred to the other hot water barrel (marked No. 2), where it is allowed to remain for ten minutes, the sack and water being agitated during the entire time, and the thermometer being carefully watched throughout the operation to see that the temperature of the water is not below 124 or above 131 degrees. If the temperature falls, more hot water must be added, or the time of immersion somewhat lengthened. If the temperature is above 129 degrees the time of immersion must be somewhat shortened. At no time must the temperature exceed 131 degrees. Seed wheat treated as above should then be dried by spreading out on a clean floor and shovelling over repeatedly until it is dry enough to run freely through the drill. A second and better method of managing the hot water is to keep two tanks, boilers, or galvanized iron tubs of sufficient capacity to hold the sack of grain well submerged, constantly at a temperature of 129 degrees over a stove or a gasoline burner, the latter being preferable because it is easier to regulate the heat.

Care must be taken not to get the temperature too high in the bottom of the tank, next the fire. A preliminary trial with a thermometer hung constantly at the depth at which the bag of seed is to hang will enable one to guage the strength of flame necessary. The greatest advantage of this method of managing the hot water lies in the fact that a larger amount of seed grain can be treated in the same length of time, since a continuous flame enables the operator to keep the water more continuously at the required temperature than by the barrel method, and with less handling of water. The planting of about one-fourth more seed is advisable, to replace any seeds of low vitality which have been injured in the treatment.

A combined treatment for both loose smut and bunt may be given by maintaining the temperature of barrel No. 1 at 120 to 125 degrees and No. 2 at 132 degrees Fahrenheit. As before, the immersion in No. 1 should be for one minute and in No. 2 ten minutes. This method has a certain disadvantage in that the temperature of 132 degrees kills a considerable quantity of grain, which must be made up for by planting from one-fourth to one-half more seed than is ordinarily sown.

Smutted grain of both sorts can easily be recognized in the field. The heads of the plants infected with loose smut are entirely destroyed and the black powdery dust (the spores or reproductive bodies) is blown about by the wind at flowering time and infects the new seeds just forming in the heads. The fungus then develops *inside* these grains and remains invisible, causing no change in the form or appearance of the berry. Such infected seeds may thus go out into the field again. The fungus inside the seed grows up inside the young seedling and makes itself visible at flowering time as before, when it forms a blackened head full of dusty spores which escape and blow away over the field.

The stinking smut changes the form of the kernel, causing it to become black and hard and abnormally large. Within these blackened kernels the wheat substance is entirely consumed by the fungus, which fills the space full of the powdery black spores. As the kernels do not break open, however, the spores do not escape into the field except where the smutted grains are accidentally broken off and trampled into the soil and crushed. When such smutted grains go through the separator, however, many of them are broken to pieces, and the spores within are scattered over the unsmutted grain, adhering in the crease, on the brush, etc.

The stinking smut is ordinarily the more prevalent of the two. Where the loose smut is abundant, change of land for a season is desirable. This will allow the smut spores that become scattered over the soil by the wind to germinate and die. If wheat is planted on land badly infected with loose smut, there is danger of the smut spores on the ground germinating and sending their germ tubes into the wheat when it germinates.

Approved:
ED. H. WEBSTER, *Director*.
MANHATTAN. KAN., September 17, 1910.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 13.

DIVISION OF FORESTRY.

Chas. A. Scott, Forester in Charge.

How to Grow Black Walnuts.

BY
Chas. A. Scott.

Under favorable conditions the Black Walnut is a tree that is easily grown. The seedlings reach a height of from 12 to 24 inches the first season, and this height growth is exceeded from year to year during the sapling and pole stages of development. The nuts should be planted where the trees are to be permanently located for the reason that the seedlings develop a very strong tap root the first season and transplanting is impractical.

THE SEED.

The nuts mature in October, and they should be gathered soon after they fall from the trees. They should not be hulled as the hull in no way interferes with germination and it protects the kernel from injury by drying. The only treatment necessary before planting is to see that the nuts do not dry out, as drying seriously injures their germinating powers.

Nuts for fall planting keep perfectly in small piles in cool, shaded places. The piles should not be made more than 12 or 15 inches in height, on account of danger of the nuts heating if the pile is large.

For spring planting the nuts should be stratified over winter. They may be stratified in moist sand or leaves in any protected place. In stratifying, a two-inch layer of sand or leaves should alternate with a layer of nuts of the same depth. The pile should be kept moist and allowed to freeze and remain frozen throughout the winter.

PLANTING.

The nuts may be planted either in the fall or in the spring with equally good results. The fall planting should be done any time after the nuts are gathered up to the time the ground freezes. The spring planting should be done as soon as the ground is in a workable condition. The danger in delaying planting until later in the season is that the nuts begin to sprout soon after they thaw out, and once through the shell the sprout is easily broken off. It is also necessary to exercise due precaution to prevent the nuts from becoming dry after they have been stratified as the germ is then very delicate and easily injured.

WHERE AND HOW TO PLANT.

The ground in which walnuts are to be planted should be thoroughly cultivated for two or three years before the nuts are planted as the trees will not make a satisfactory growth in virgin soil. The Black Walnut is a tree that requires the deepest, richest soil that can be found along creek and river valleys for its best development, yet at the same time it makes a very satisfactory growth on the prairie soil of the eastern part of the state. In the western part of the state the planters should select the low ground along ravines for planting sites when possible.

The nuts should be planted three feet apart in furrows ten feet apart and not more than four inches in depth. After the nuts are planted the furrows may be filled in with a cultivator. It is not necessary or even desirable to level the ground more than is required to securely cover the nuts. If the furrows are not leveled they will catch the excess surface water in times of heavy rainfall.

If the nuts cannot be planted in furrows the next best plan is to plant them in seed spots. Seed spots are places where several nuts are planted in an area sixteen or eighteen feet in diameter to ultimately form a small group of trees. The ground for such planting should be spaded and pulverized so as to increase the moisture-holding capacity of the soil, and from six to ten seeds should be planted in each seed spot.

CULTIVATION AND CARE.

On account of the Black Walnut being a lover of moist, rich soils it is very sensitive to dry, parched conditions. It is therefore very necessary to give the seedling trees the best of cultivation until they develop a good root system and take possession of the ground. Thorough surface tillage that will maintain a dust mulch is the most desirable cultivation. When it is impossible to give the trees such cultivation, as in the case of seed spot planting, it is a good plan to mulch the ground with straw to keep down the grass and weeds. In all events keep the ground around the seedling trees free of weeds and grass sod.

After the walnut trees are five or six years old it is often advisable to underplant them with such trees as the box elder, green ash, or red cedar, so as to completely shade the ground. Shading the ground and keeping out the weeds and grass are factors vastly more important in tree culture than most people are willing to believe. The walnut has very light foliage and the grasses and weeds soon take the ground unless some other trees with heavier foliage are planted with them.

Approved:
ED. H. WEBSTER, *Director.*

MANHATTAN, KAN., November 11, 1910.

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Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 14.

DEPARTMENT OF VETERINARY SCIENCE.
F. S. SCHOENLEBER, in Charge.

Contagious Abortion.

BY
K. W. STOUDER.

Many terms are used in discussing this trouble, such as "slinking," "casting," "losing," "aborting," etc., the idea being conveyed that the young is cast out of the womb before it is fully developed and capable of separate existence.

CAUSES. Abortion may be brought about in many ways. The principal causes probably are injuries to the mother from fighting, falling, kicks from other animals, drinking excessively of very cold water, exposure to severe or sudden changes in the weather, and the eating of spoiled, frozen or moldy foods, especially wheat or rye, which contain ergot or smut. Improper hygienic surroundings also contribute, especially in stabling, breeding too young, inbreeding, and severe constitutional diseases. The death of the fœtus itself is at times responsible.

When any of the accidental or explainable causes cannot be assigned to the case, contagious abortion is always to be suspected, for it is common in this state and easily spread from one animal to another. The failure of many mares and cows to breed may often be attributed to this trouble. The diseased animals are often able to infect those with which they associate, so it is readily seen that the immediate loss of the young animal is not the only loss sustained by a herd in which this disease may get a foothold. It frequently results in many months of sterility or possible loss of increase completely, as well as infection of new herds or animals replacing the old herd.

There can be no doubt of the fact that the disease is of germ origin, or infectious, as we more properly say. The fact that it spreads rapidly from one animal to another, and that, experimentally, it can be produced by the introduction of the discharge of an affected animal into the vagina of a pregnant animal, both conclusively prove this point.

The germs of the disease are found in the vagina and uterus of affected animals and are passed out with the discharge from these organs, therefore the membranes and discharges from a case of abortion should always be buried, burned or thoroughly covered with strong and efficient disinfectant.

This is one disease where it is obvious that prevention is worth vastly more than an attempt to cure, mainly because the trouble is as a rule not suspected to be present till it has occurred, therefore treatment is directed to those animals supposed or known to be affected, and the known exposed ones, applying those sanitary measures necessary to check its spread.

Considerable experimental work has been done in attempting to control the disease and various methods have been more or less successful in herds that were affected in a mild form. This Station carried on a series of experiments by using locally, at various periods of time, capsules filled with icthyol and other disinfectants. Also giving salol internally. None of these methods proved as satisfactory in controlling the disease as the following:

TREATMENT. Burn the fœtus and membranes, together with all litter soiled with the fluids. Clean out the barn and burn the refuse. Whitewash the walls with spray or brush with a solution of corrosive sublimate, one ounce in eight gallons of water and lime. Repeat this process often and get all drains and floors well covered with the antiseptic fluids.

Separate aborting animals from those supposed not to be affected and keep them separate until they are entirely well. Wash off the tail and surrounding parts of all animals with a solution of creolin or phenol, two per cent in water, and irrigate the uterus with a two per cent solution of phenol in water kept thoroughly mixed. This is best performed by using a funnel and hose five or six feet long, inserting one end in the uterus, and pouring the antiseptic solution into the funnel, allowing it to run in gradually.

Many animals, even those which have persistently refused to breed, can be made profitable breeding animals again by the following method:

Boil and cool one quart of soft water. Add to it five drams of pure crystals of phenol. Keep this solution in a well corked, sterilized bottle, shaking it vigorously each time before using any of it. Get a hypodermic syringe, similar to those used in vaccinating for blackleg, and treat the affected animals by injecting under the skin about one to one and one-half ounces of this solution, putting one to two drams at different points of the body. Repeat every seven to ten days till about six treatments are given. After about two treatments, increase the dose to all the animal will stand. To do this, give one or two extra syringes full and wait a little while, all the time watching the eyes. If the pupil dilates, enough has been given. An overdose makes some animals quite sleepy, or they stagger a little, but these symptoms are not dangerous and soon wear off. To give all the animal will stand without staggering is good practice after about the second treatment.

If faithfully followed, the above directions should rid any herd of contagious abortion in a short time and place it in a profitable condition from a breeder's standpoint.

If any of the animals show signs of aborting at any time, give two to four drams every day for a time and it will probably check the tendency. To herds suspected of possible trouble, thoroughly mix one pound of phenol with five pounds of salt, and give to each animal a tablespoonful of the mixture in a bran mash every other day for a week. This will probably prevent the threatened abortion.

Bulls which have served aborting cows can spread the disease, so the sheath should be irrigated before and after each service, the same as was directed for the irrigation of the vagina in the female. The bulls should also be given the hypodermic treatment and should be isolated and kept from associating with herds wherein the disease has not been found.

Some cows and mares have repeatedly failed to conceive after service, and this condition is often due to an acidity of the fluids of the uterus which prevents conception. This difficulty is best overcome by soaking a cake of ordinary yeast in about a quart of lukewarm water over night, keeping it at about body temperature all the time; this solution should be strained through a clean muslin cloth and injected into the vagina of an animal a few hours before service. It neutralizes the acids and overcomes the trouble in many cases.

Approved:
Ed. H. Webster, *Director.*

Manhattan, Kan., November 12, 1910.

The number of this Circular should be 15 instead of 17

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 17.

DEPARTMENT OF HORTICULTURE.
ALBERT DICKENS, in Charge.

DEPARTMENT OF ENTOMOLOGY.
T. J. HEADLEE, Entomologist and Zoölogist in Charge.

SPRAYING APPLES.

BY

ALBERT DICKENS and T. J. HEADLEE.

RETURNS.

During the past summer season, working in seven different and widely separated orchards in southeast Kansas in coöperation with the Bureau of Entomology and interested fruit growers, the Agricultural College has been able to increase the average yield of merchantable apples four bushels per tree by spraying alone. This means when sold as orchard run a net profit of $1.62 per tree, or $97.20 per acre; and when properly graded, packed and marketed, nearly double that amount. These returns are neither the best nor the poorest, but represent the average good derived from spraying in all the orchards. An average of thirty-seven per cent more fruit per tree was produced on the sprayed blocks than on those unsprayed. Nor do the good results of the spraying appear fully in the actual increase in merchantable fruit, but are to be found also in the increased proportion of high-priced grades. The merchantable fruit from sprayed trees showed an average of fifteen per cent more No. 1's and seven per cent more No. 2's than that of the unsprayed trees.

These seven orchards included both home and commercial types, and were composed of all the varieties recognized as standard in Kansas. One home orchard under treatment consisted of approximately 200 trees distributed through thirty-three varieties.

In determining the effect of the spraying on insects and fungi more than a quarter of a million of apples were individually examined. In 1909 very few or no apples were grown in these orchards, consequently the proportion of infested apples from unsprayed trees was very much less than has been the case where crops of apples are borne in successive years. The twenty-seven per cent of unsprayed fruit injured by codling moth was reduced by spraying to five per cent; the fifty-two per cent injured by curculio to twenty-nine per cent; the eighteen per cent injured by scab to one per cent; the twenty-three per cent injured by apple blotch to seven per cent; the twenty-one per cent injured by sooty blotch to two per cent. The thirteen per cent of the fruit which was found absolutely free from insects and fungous injury on unsprayed trees was, by spraying, increased to sixty per cent. Bordeaux mixture burned twenty-five per cent of the apples treated, while lime-sulphur burned only six per cent.

It is the purpose of the authors of this circular to point out the value of proper spraying, and to state the methods by means of which owners of home and commercial orchards may achieve as good or better results. A more complete statement of this whole matter is made in Kansas State Experiment Station Farm Bulletin No. 175.

RECOMMENDATIONS.

It should go without saying that the orchard from which one expects to get fine apples should be well pruned, well cultivated, and well fed. No amount of spraying will make trees which do not set apples, either because of lack of proper growing conditions or frost, produce fruit. Spraying is intended merely to insure a large percentage of the apples which do set against the ravages of insects and of fungous diseases. To render spraying worth while, all measures which look toward a strong set of apples must be taken.

NUMBER OF SPRAYS.

In view of the fact that these sprays are intended to destroy fungous diseases which develop throughout the growing season, it appears that at least four sprays should be used, and that they should be concentrated at the beginning of the season in such a manner that the foliage and fruit may be covered by a protective substance when the disease spores are sprouting and beginning to attack the rapidly growing and consequently tender fruit and foliage.

TIME OF SPRAYING.

There is a right time to spray. The first spraying, which is intended to destroy apple-scab fungus, canker worms, bud worms and leaf feeders generally, should be applied just after the cluster cups open and just before the flower buds unfold. The second spray, which is intended principally for codling moth and secondarily for curculio and scab and blotch fungi, should be given at the dropping of the blossoms and before the calyx lobes close. This may begin when the blossoms are one-half to two-thirds down. The third spraying, which is intended for codling moth, curculio, scab, blotch, black and bitter rot, should be given about three weeks after the blossoms fall, because by this time the first brood of codling moth larvæ is hatching and the fungus-killing mixtures have probably been largely washed from the trees. The fourth spraying, when bitter rot is not anticipated, consists of arsenate of lead alone. It is intended primarily for second brood codling moth larvæ, and secondarily for general leaf and fruit feeders. It should be applied about ten weeks after the blossoms fall.

Spraying Machinery.

Spraying machinery is intended to deliver the spray mixtures in such a way as to cover the trees thoroughly in the shortest possible time. This is accomplished by placing the liquid under pressure and delivering it through a small aperture, whereby it is broken up into a fine mist which can be driven upon all parts of the tree. The first consideration, then, is the power, and the second the pump, the hose, extension rods and nozzles.

The power is usually derived from man work, gasoline engine or compressed air. The first is the cheapest and most practical when less than 500 trees are concerned, but when 500 to 2000 trees must be treated a gasoline engine is needed, and when more than 2000 trees are to be sprayed compressed air might be profitably employed.

It is quite possible that some growers, owing to scarcity of labor, will find the gas engine most practical for a smaller number of trees than 500. The objection to the gas engine for more than 2000 trees lies in the fact that more than one outfit must be employed, necessitating the employment of an engineer for each, who, if satisfactory, is usually high priced. It is better when several outfits are needed to purchase a good gas or steam engine and a compresser, by means of which an abundance of power can be produced for all outfits. In our experience spraying done by means of a gas engine outfit, when the engine runs well, costs, other things being equal, a little more than one-half as much as when done by hand power. The reduction in cost should be almost as great when compressed air is employed.

Whether the source of power is muscle or gasoline, the spray is put under pressure by means of a force pump. A satisfactory pump, regardless of the power to be employed, should have the following points: (1) all parts that come in contact with the spraying fluid should be made of brass, which will not be corroded by any of them; (2) the air chamber should be so large that the liquid will be delivered in a steady stream, instead of in a succession of spurts; (3) all working parts, especially the valves, should be so made that they can be easily gotten at and cleaned; (4) the parts should be so arranged that they will have the minimum chance of breakage should the pump fall (this applies particularly to the barrel pump, which is always likely to tumble off the wagon or cart—and can best be insured by having a pump the working parts of which are mainly in the barrel); (5) when gas engine is geared to pump, both pump and engine should be immovably fastened upon the same base, preferably of iron or steel.

The hose should be long enough to permit the operator to reach every part of the tree. In our experience twenty-five-foot lengths have proven most generally useful. Ordinary garden hose connections are not satisfactory when much pressure is to be employed, because the part which is thrust into the hose is too short and too smooth; under heavy pressure such connections are likely to slip and make trouble. Hose connections having an especial length and roughness of shaft are desirable. The hose should end in an extension rod of some sort, either bamboo, brass lined, or ordinary gas pipe uncovered. The extension rod should bear one or more nozzles, depending upon the amount of preasure to be used. Two types of spray are used, the strong dashing type and the mist type. The first type is produced by the Bordeaux nozzle and the second by the Vermorel or "Friend" nozzles. In our experience the "Friend" type of nozzle has proven a little the more satisfactory, because it never catches in the branches of the tree. All joints from pump to nozzle-opening should be made so tight that no liquid can escape.

SPRAYING MATERIALS.

We spray the apple orchard to destroy insects and fungi that would, if unchecked, reduce or completely destroy the crop. The insects that do most of the damage to foliage and fruit bite off and consume pieces of fruit and foliage. They can be destroyed by placing a stomach poison at the proper time on the food which they use. Arsenic combined with lead (arsenate of lead) has been found best for this purpose, because it adheres for a long time to fruit and foilage and has so little free arsenious acid in it that we have never known it to burn appreciably.

The methods by which the several important destructive fungi gain entrance to the tissues of fruit and foliage are much alike. A small spore is blown upon the surface of the fruit or leaf. Under the influence of moisture the spore bursts and the growing sprout emerges. It finds its way through the skin of the fruit, grows inside the tissue and produces spores which, escaping from the dead tissue, spread the disease to other and healthy tissue. If, while the spore is sprouting, it be brought into contact with a substance deadly to it, it will perish. Of course, this deadly substance must be just strong enough to kill the young fungus plant and not strong enough to injure the foliage and fruit of the apple. Copper sulphate or blue vitriol when combined with milk of lime, forming Bordeaux mixture, has been found, beyond doubt, to kill the injurious fungi and not very seriously injure the apple. Of recent years, however, accumulated experience has shown that even the weakest Bordeaux will, if its application be closely followed by rain, badly burn both the foliage and fruit of certain susceptible varieties. This fact has led to a search for a substitute. Of those tried, lime-sulphur has proven the most promising. For all the common apple diseases except apple blotch, lime-sulphur properly used has proven a satisfactory substitute for Bordeaux.

Our experience would lead us to recommend the use of Bordeaux plus arsenate of lead on varieties of apples especially susceptible to blotch, or upon those not subject to Bordeaux injury, and lime-sulphur plus arsenate of lead on varieties not likely to be badly injured by blotch. We would further recommend the 3–4–50 formula for Bordeaux plus two pounds of arsenate of lead, or 1½ gallons commercial lime-sulphur (testing 30° to 33° Beaumé) to 50 gallons of water plus two pounds of arsenate of lead.

Although we have not tried it, it seems likely that a combination of lime-sulphur and Bordeaux mixture might protect even the varieties subject to blotch and at the same time avoid much of the burning; say, make the first two applications with the lime-sulphur combination and the third with the Bordeaux combination. This can be taken only as a suggestion.

METHOD OF APPLICATION.

The method of application should be made to vary with the object to be gained. All sprays except the one given at the dropping of the petals are intended to coat as completely as possible both foliage and fruit with the mixtures. They are therefore delivered as a fine mist from both ground and tower in such a manner as best to effect this object. The spray at the dropping of the petals is intended to fill the open calyx end of the apple with poison, because eighty per cent of the first brood and a large percentage of the second brood of apple worms enter the fruit through this door, and because soon the calyx lobes will roll together, enclosing the poison and holding it there for all comers. When this spray is delivered the young apple stands with the calyx opening upward and the filling can best be accomplished by shooting the spray into it from above downward under great pressure. There is a difference of opinion among experimenters as to whether the second spray delivered as a dash is more effective than if delivered as a mist.

With the ordinary spraying machinery efficient spraying cannot be done with pressure of less than eighty pounds, and the work can be much more satisfactorily and rapidly done with a pressure of 200. Good types of barrel pumps will give pressures ranging from 60 to 120 pounds, with an average of about eighty. Gasoline and compressed air sprayers will give pressure from 120 to 225 pounds.

Schedule of Application.

Varieties Not Likely to be Seriously Injured by Apple Blotch.

First Application—Between the opening of the buds and the opening of the blossoms, thoroughly spray the trees with one and one-half gallons lime-sulphur plus two pounds of arsenate of lead to fifty gallons of water. Apply through fine-holed nozzles as a fine mist, and make every effort to see that all parts of the unfolding foliage are given a complete and even coat of the mixture.

Second Application—Beginning when the petals are one-half down and finishing within five or six days of the complete dropping of the blossoms, spray the trees thoroughly with the same mixture, making an especial effort to fill the up-turned blossom ends of the apples with the mixture. The best results in this spray can be obtained by shooting it from a tower down into the blossom ends under the greatest possible pressure, 200 pounds being much better than eighty pounds, and eighty pounds being the least pressure with which satisfactory work can be done.

Third Application—Three weeks after the blossoms fall spray the trees thoroughly with the same mixture, making every effort to give the fruit and foliage an even and complete coat of the liquid.

Fourth Application—About ten weeks after the blossoms fall spray the trees thoroughly with arsenate of lead alone, using two pounds to fifty gallons of water, delivering the mixture as a fine mist, and making every effort to see that all parts of the fruit and foliage are given an even and complete coat.

If bitter rot is anticipated, this application should be made with the same material as the preceding three.

Varieties Likely to be Seriously Injured by Apple Blotch.

Use exactly the same treatments as those suggested under the previous heading, except that for lime-sulphur 3–4–50 Bordeaux mixture should be used.

PREPARATION OF THE LIME-SULPHUR COMBINATION.

The commercial lime-sulphur solutions made use of during the past summer tested from 30° to 33° Beaumé. One and one-half gallons of the solution proved sufficiently strong to control in a satisfactory manner all diseases except apple blotch, and injured only six per cent of all the apples treated with it. In using this solution the spray tank should be filled with water, the right amount of the lime-sulphur solution measured out and emptied into the tank full of water. After thorough agitation the mixture is ready to apply. If a poison is needed, two pounds of arsenate of lead to fifty gallons will prove satisfactory. Mix the lead first with a small amount of water until it will pour readily, then empty it into the mixture, agitate it vigorously, and the combination is ready for use.

PREPARATION OF THE BORDEAUX COMBINATION.

To make Bordeaux mixture properly and speedily, four tanks are required. Two should be for stock solutions of lime and copper sulphate, and two should be for dilutions. Each dilution tank should have one-half the capacity of the spray tank. In preparation of stock solution of copper sulphate, fill the tank with water, place twice as many pounds of copper sulphate in a burlap bag, or other loosely woven sack, as there are gallons in the tank, and suspend this copper sulphate filled bag in the water by tying it to a pole which extends from one side of the tank to the other. The copper sulphate should be put to soak the night before it is to be used and by morning it will have been dissolved. In preparation of the limewater take twice as many pounds of good stone lime (all of which will slake completely and leave no lumps), place it in the lime stock solution tank and put enough water on it to slake it. After slaking is complete, fill the tank with water. Thus the stock solutions are made at the rate of two pounds to the gallon. When ready to make fifty gallons of Bordeaux mixture, first stir the stock solutions thoroughly, then put 1½ gallons of the copper sulphate water into the copper sulphate dilution tank, put two gallons of the limewater into the lime dilution tank, and fill both tanks with water. After stirring the diluted mixtures, allow them to run together through a burlap or other strainer into the spray tank, and the very best type of (3–4–50) Bordeaux mixture will be the result. Bordeaux mixture should be alkaline. If, on dropping a few drops of potassium ferrocyanide solution, which can be obtained from any druggist, into the Bordeaux, no change occurs, the solution is alkaline and satisfactory. If, on the other hand, the potassium ferrocyanide drops turn brown on striking the liquid, the Bordeaux is acid and enough limewater should be added to make it alkaline. Mix the arsenate of lead with Bordeaux as with the lime-sulphur, and the combination is ready to apply.

Unless the orchardist has a very large amount of spraying to do it will hardly pay him to make his own lime sulphur, but there is nothing better than home-made Bordeaux.

APPENDIX.

Dealers in Insecticides, Fungicides, and Spraying Apparatus; Insecticides and Fungicides; Arsenate of Lead—Grasseli Chemical Company, St. Louis, Mo.; Merrimac Chemical Company, Boston, Mass.; Agents McPike Drug Company, Kansas City, Mo.

Lime-Sulphur Concentrate—Grasseli Chemical Company, St. Louis, Mo.; Rex Company, Omaha, Neb.; Sherwin-Williams Company, Kansas City, Mo.

NOTE.—There are many excellent brands of lead arsenate and lime-sulphur in the market, but to avoid confusion we are naming only those which we have found satisfactory.

Copper Sulphate and Lime—Copper sulphate can be furnished by any reputable supply house. Satisfactory lime can be had from any reputable dealer.

Dealers in Spraying Apparatus—T. Lee Adams Seed Company, Kansas City, Mo.; Cushman Power Sprayer Company, Lincoln, Neb.; John Deere Plow Company, Kansas City, Mo.; The Demming Company, Salem, Ohio; Field Force Company, Elmira, N. Y.; Goulds Mfg. Company, Seneca Falls, N. Y.; Hardy Mfg. Company, Hudson, Mich.; H. L. Hurst Mfg. Company, Canton, Ohio; Morrill & Morley, Benton Harbor, Mich.; T. E. Myers & Bro., Ashland, Ohio; Niagara Sprayer Company, Middleport, N. Y.; Underwood & Viles, Hutchinson, Kan.; Wyandotte Seed Company, Kansas City, Kan.

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Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 16.

DEPARTMENT OF ENTOMOLOGY AND ZOOLOGY.
T. J. HEADLEE, Entomologist and Zoölogist in Charge.

Burning Chinch Bugs.

By T. J. HEADLEE.

Burning Chinch Bugs.

WHERE THEY ARE AND THE DANGER.

Again the chinch bugs have established winter quarters in clump-forming grasses. They may be found more or less under all sorts of cover, but the threatening bulk of them has gathered in the bunch-grass. Those parts of the state greatly troubled with chinch bugs have much of this grass, and the problem of chinch-bug destruction during the dormant season involves the destruction of it and other grasses of similar habit. Of the clump-forming grasses, the species commonly known as "bunch-grass" (*Andropogon scoparius*) is most sought after by the bugs. The stems, standing upright and close together, form a dense upstanding shelter, protecting the bugs from rigors of winter. Indeed, effects of the chinch-bug fungous disease are rarely seen in infested clumps, nor have we ever known the disease to spread in such places, although we have many times distributed bugs dead and covered with the spores through the clumps infested by large numbers of healthy bugs. At the same time we have found the bugs dead and dying of the disease under cover which compelled them to lie close to the moist soil.

That the bugs have gathered this year in dangerous numbers is shown by careful counts made at Conway Springs and at Hays. Five clumps of bunch-grass taken at the former place gave an average of 1000 bugs each, and eight clumps examined at the latter place showed 400 apiece.

Bunch grass, the winter home of the chinch bug. Burn it.

When we consider the immense number of clumps of bunch-grass to be found in pastures, along roadsides and fences, and in waste places generally, it is easy to comprehend how threatening the situation looks. Certainly, if all the bugs now in winter quarters get through the winter safely and experience a dry and favorable spring and summer, Kansas crops will suffer a loss of many millions of dollars.

HOW TO FIND THE BUGS.

The farmer must know for himself whether he has bugs in his grass lands. This he can determine by parting the stems close to the place from which they start. Ordinarily a mulch of soil and decayed grass will have gathered at the base of the stems. He should look carefully in this and should not give up the search at once, because the bugs play 'possum and are not easily seen until they move. If the bugs are abundant they will be revealed by this search. In case more careful

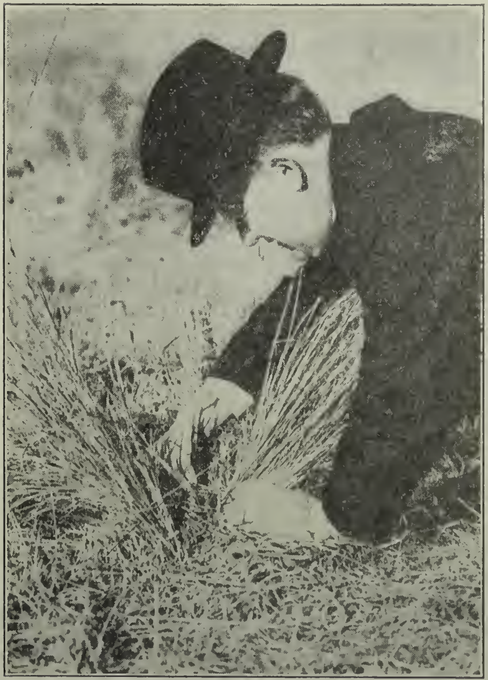

FIG. 1. In this way you can find the bugs if they are abundant.

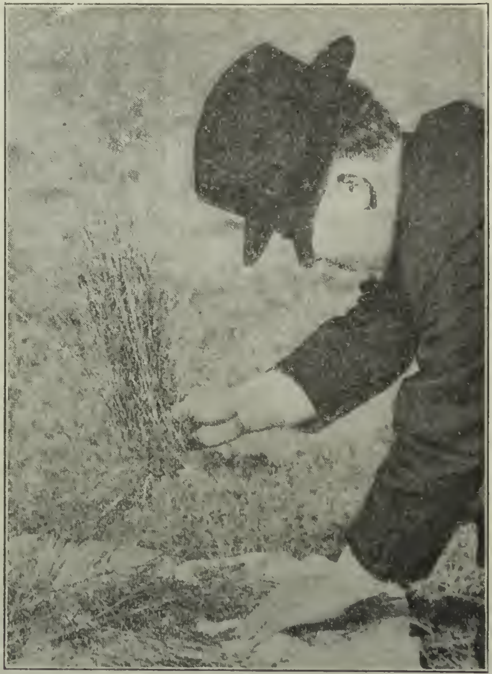

FIG. 2. In this way you find them if they are present in numbers to bother with.

looking is required to find them, take up a clump of the bunch-grass, root and all, and pick it to pieces over a large sheet of white paper or cloth, watching for the bugs. If they are present in any numbers worth considering, this should reveal them.

WHAT TO DO WITH THEM.

Having found that the bugs are present in considerable or large numbers, the next step is to determine where on the farm these clump-forming grasses are to be found. Then a practicable method of destroying the bug-infested clumps, which will at the same time destroy the bugs, must be selected. Fire at once occurs to one as the most practical and efficient agent to be employed for this purpose. Obviously fire must destroy the bugs in one or both of two ways: first, by burning them, and, second, by destroying their cover and leaving them exposed to the rigors of winter. The first method requires either that sufficient heat shall be generated to effect their destruction or that they shall actually be partly or completely consumed by the fire. The first requires an unusually hot prairie fire, such as might result from the consumption of a very heavy cover. The second requires very close burning—consumption of the stems to within about half an inch of the crown. Little harm seems to be done to the bugs by ordinary

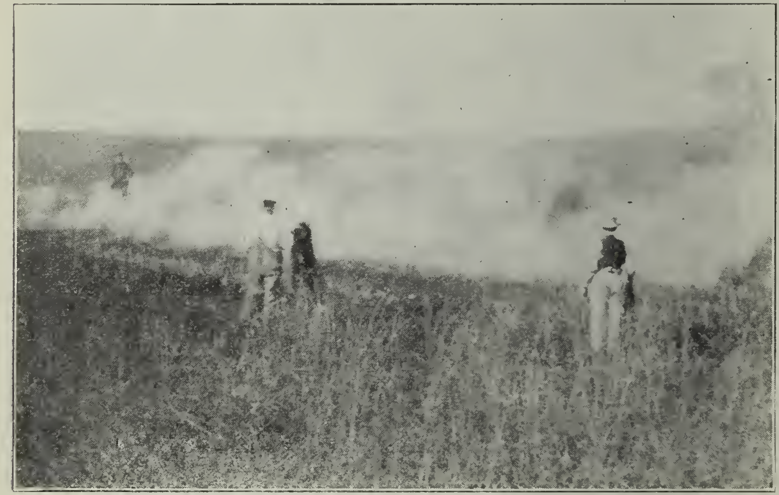

FIG. 3. What should be done with bug infested grasses, in waste places, along roadsides and fences, in pasture and mown meadows of native grass.

prairie fires, which do not burn closer than one inch from the crown.

The prime requisite, then, in firing the infested clumps of grass, is so to handle the fire as to make it burn close to the crown from which the stubble grows. The type of firing which gives this desirable result appears to vary with weather conditions and must be selected by the individual farmer at the time of treatment.

At this point it is worth while to consider the results of recent burning tests upon which the preceding conclusions are founded.

TABLE OF RESULTS FROM BURNINGS MADE RECENTLY IN ELLIS COUNTY.

Clump No.	Size of clump, diameter.	Date of burning.	Type of fire.	Degree of burning.	Total No. of living bugs.
1	5 inches	No burning.	No burning.		136
2	5½ “				258
3	5 “				91
4	4½ “				214
5	5 “				1,111
6	5 “	Nov. 19, '10	Side fire	Within 2 inches of crown	488
7	5 “	“ “ “	“	Almost to crown	2
8	5½ “	“ “ “	Back fire	Almost to crown	1
9	5½ “	“ “ “	“	Within 1 inch of crown	441
10	3 “	“ “ “	Head fire	Almost to crown	0

The Ellis county table shows: (1) That the clumps of bunch-grass averaging five inches in diameter contained about 400 bugs each; (2) that the prime requisite for destruction of the bugs is close burning; (3) that close burning will destroy practically 100 per cent; (4) that the direction from which the fire comes has little to do with its efficiency, and that in all probability different conditions of weather and locality will render different types of firing suitable at different places and at different times in the same place.

IN SUMNER COUNTY.

Clump No.	Size of clump, diameter.	Date of burning.	Total No. of bugs.	Total No. bugs killed.	Percentage killed.
1	3½ inches	Nov. 11, '10	2,574	2,134	86.4
2	2½ “	“ “ “	111	83	74.7
3	3½ “	“ “ “	1,074	434	45
4	2 “	“ “ “	211	175	83
5	2½ “	“ “ “	960	459	43

The Sumner county table shows: (1) That the clumps of bunch-grass three inches in diameter sheltered an average of 1000 bugs apiece; (2) that running fire over infested grasses under varied conditions will destroy 43 per cent to 86.4 per cent of the bugs. The notes show that clump No. 1 in the Sumner county table had a stubble one inch long, but they also show that the cover was unusually heavy and that the heat generated was correspondingly high. Evidently, therefore, when the heat generated is for any reason unusually great the burning may not be so close and yet be effective. All things considered, however, in general the secret of destroying the bugs directly appears to lie in close burning of the infested grass clumps.

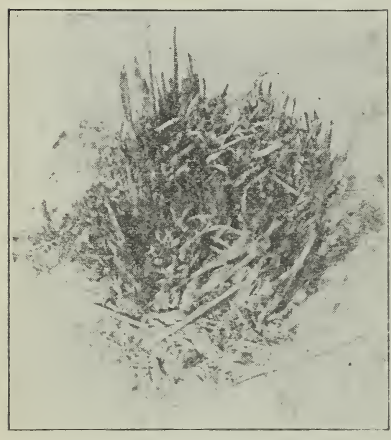

FIG. 4. The type of burning that kills few bugs—not close enough.

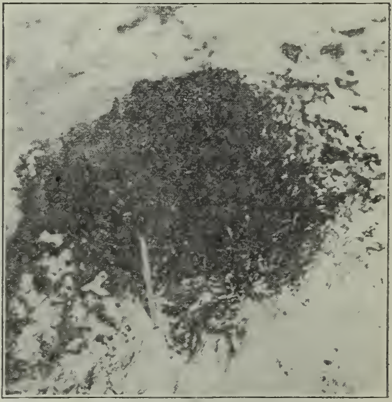

FIG. 5. The type of burning that kills practically 100 per cent of the bugs.

There will be a question in the minds of some as to whether close burning will not injure pasture lands and meadows. Most farmers with whom we have worked believe that it will not seriously harm the grass or decrease the yield, especially when done only once in several years. In this connection it is worth while to note that while parts of the railroad right of way are burned off every fall, the grass is not killed out.

CONCLUSION.

1. The chinch bugs have gathered in dangerous numbers in the clump-forming grasses of the badly infested parts of the state.

2. Most of the bugs can be destroyed by running fire over

the infested grass lands in such a way as to burn the clumps down close to the crowns, and the balance will thereby be exposed to the rigors of winter.

3. Never have conditions for winter destruction of chinch bugs been better. The grasses are so dry that close burning is easy.

4. Neglect to destroy these bugs, and with winter, spring and summer favorable to them, wheat, corn, cane and Kafir will suffer severely, and will in many cases be completely destroyed.

Approved:
ED. H. WEBSTER, *Director*.
MANHATTAN, KAN., November 28, 1910.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 17.

DEPARTMENT OF ENTOMOLOGY AND ZOOLOGY.
T. J. HEADLEE, Entomologist and Zoölogist in Charge.

PROTECTING TREES FROM RABBITS.

BY
J. C. CUNNINGHAM, Assistant in Horticulture.

Protecting Trees From Rabbits.

In Kansas the damage done by rabbits is comparatively light and yet many young orchards, young shade trees, and windbreaks, so much needed in our state, have been partially or completely destroyed.* Repeated requests for advice as to how to protect trees from their ravages has led to the publication of this circular,† which is based partly upon work done at this station and partly upon that done elsewhere.

CLEAN CULTURE.

It is very important to remove all brush piles and thickets, which may serve as breeding places and for safe hiding.

TRAPPING.

Traps of various sorts may be constructed. A simple and successful method is to sink a barrel in the ground level with its surface. Fit the head slightly smaller than the top and allow it to swing freely on a rod or old broomstick. Pieces of apple or grains of corn may be placed on the outer edge of the cover and when the rabbit attempts to get these, the lid tips up and he slides into the barrel, while the lid, which is slightly heavier on one side than the other, assumes its original position. The heavier side should strike against a heavy nail or bolt so that only the lighter side of the lid will drop. The whole thing should be covered over with brush or light flat stones so as to make an enticing place for the rabbits.

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* The investigations relative to injurious mammals is a part of the work of the Department of Entomology and Zoölogy, but in this particular instance it was most convenient for Mr. Cunningham of the Department of Horticulture to make the observations and get together the information here given. The circular is published as a part of the work of the Department of Entomology and Zoölogy.

† Aside from the work with the buttermilk and soot spray and with the sunken barrel traps, this work is entirely compilation.

A novel and ingenious trap for catching rabbits has been designed by Walter Wellhouse, and used with remarkable success by him in his orchards. The trap consists of a box made of fence boards (old ones preferred) six inches wide and one inch thick. The boards are cut twenty-two inches long and the top and bottom boards are nailed onto the side boards, thus making the opening four inches wide and six inches high. The door, *D*, is made of wire, shaped as shown in fig. 4, and hung with two staples, *cc*, to the under side of the top board. To prevent the rabbit from pushing the door open, a strip

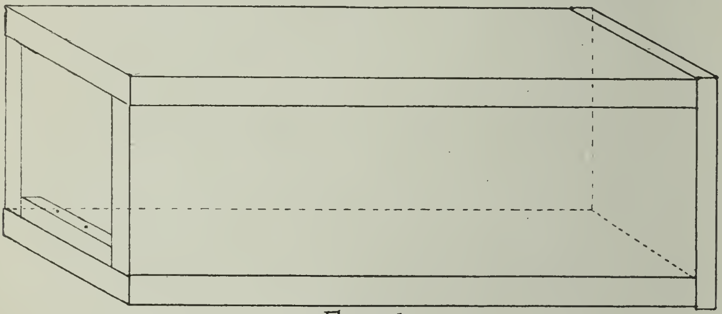

FIG. 1.

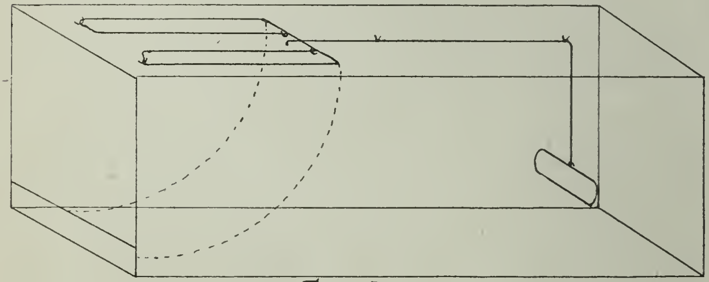

FIG. 2.

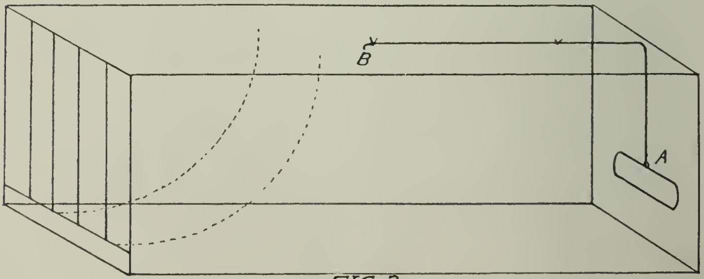

FIG. 3.

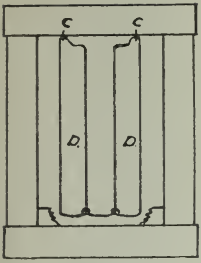

Fig. 4.

three-fourths of an inch square is inserted in the opening and nailed to the bottom board, as shown in fig. 1, and in part in fig. 4. The door must be made long enough to reach well below this catch, as shown in fig. 4. The trigger is made of wire, bent as shown in figs. 2 and 3, and hung loosely with two staples to the center of the top board. These staples must be carefully placed, to allow the trigger to be pulled forward far enough so that the door will rest upon it when the trap is set, and also to allow the loop in the trigger, *A*, fig. 3, to be pushed against the back of the trap by the rabbit when it is sprung, thus preventing its being bent. To operate the trap, push the door, *D*, inward, and with the forefinger catch the hooked end of the trigger, *B*, fig. 3, and pull it forward until the door rests upon the wire above the hook. The rabbit enters the trap, prompted by curiosity or otherwise, just as he enters a hollow log, and thinks no more of the wire trigger than he would of a small piece of brush which he must push out of his way. As soon as he touches the trigger, the door drops and the rabbit is caught. No bait is used and the trap cannot easily be sprung by birds or wind. Care must be taken to see that all staples are loosely set so that the trigger slides easily and the door will drop of its own weight. If new boards are used, it would be well to stain with some dark coloring material which is not offensive to the rabbit's delicate sense of smell.

WRAPPING.

Where one has only a few trees, such as fruit or shade trees, the most satisfactory method is to wrap them. An ordinary tree veneer which is made of very thin wood may be purchased from any seed store or nursery company. This fits closely about the body of the tree and will enlarge as the tree grows. However, during the summer it may offer a harbor for injurious insects, and should remain on the tree only during the winter. Trees may be wrapped with burlap, corn stalks, or ordinary lath. The only caution with any of these is to remove them when the tree resumes growth in the spring. Ordinary wire screen answers very well as a protection for the tree and does not harbor insects.

REPELLANTS.

The tree may be covered as far as the rabbit can reach with blood. The entrails and blood of the rabbit itself rubbed over the tree is quite effective, but is very apt to be washed off by rain. A concoction of tallow and tobacco smeared onto the trees acts as a repellant. However, where there are a great many trees, and especially small trees, such as honey locust elm, and others used as windbreaks, it is out of the question to treat each individual tree by hand. In this case a spray applied by a hand pump will be found effective. The common lime and sulphur spray used to destroy the San José scale has been recommended and can be applied with an ordinary spray pump. Mix together dry fresh hydrated or ground lime, 4 pounds; powdered sulphur, 3 pounds. Add water to form a thin paste and boil from one-half to one hour, or until the mixture becomes a reddish amber color. Dilute to 10 gallons, spray onto the trees while the liquid is still warm. This spray is excellent for the trees as well, but must not be applied to the trees while they are in leaf.

Commercial aloes at the rate of one pound to four gallons of water sprayed onto the trees gives the bark and leaves a bitter taste which repels rabbits.

A spray made of buttermilk and common stove soot has proven quite satisfactory here. Buttermilk, one gallon; common stove soot one-half pound. Boil for twenty minutes. Keep well stirred to prevent clogging the pump.

POISONING.

Much may be done in eradicating this pest with poison. The "Wellhouse" poison is made as follows: Sulphate of strychnine, 1 part; borax, one-third part; white syrup, 1 part; water, 10 parts. Put the mixture into a jug or large bottle and shake well. Cut fresh twigs—apple water sprouts are best—and with a small brush paint them, especially over the terminal bud, with the above preparation. Scatter the twigs in the runways and about the trees where the rabbits feed. Stock or fowls will not molest this poison and it is said that dogs may eat the dead rabbits and suffer no ill effects.

The Western Australia Department of Agriculture recommends a poison somewhat similar. Dissolve 1½ ounces strychnine in 1 quart of vinegar; dilute with 5 gallons of water; add 2 pounds of flour and 1 pound of sugar; stir well and apply to twigs as recommended above.

A jam made of fruit and sugar is readily eaten by the rabbits. Chop apples or melons into small cubes. Add sugar equal to one-half the weight of the fruit. Boil until the mass forms a thick jam. Add strychnine, either powdered or dissolved, at the rate of one ounce to 25 pounds of the jam, and mix thoroughly.

Approved:
Ed. H. Webster, *Director.*

Manhattan, Kan., February 1, 1911.

Kansas State Agricultural College

EXPERIMENT STATION.—Circular No. 18

DIVISION OF
FEEDING STUFF REGISTRATION

The Kansas Feeding Stuffs Law Revision of 1911

REGULATIONS AND EXPLANATIONS

Kansas Feeding Stuffs Law

The Kansas legislature, at the session of 1907, passed a law with reference to the sale of concentrated feeding stuffs. This law was amended at the special session of 1908 and again amended at the regular session of 1911.

The law as amended reads as follows:

SECTION 1. For the purposes of this act concentrated feeding stuffs are declared to be all materials sold, offered for sale or held for sale within the State of Kansas and designed for the nutrition of animals of any species, if such materials have been subjected to any mixing process or subjected to any process whereby the composition of the original material is altered. Condimental feeds, medicated stock foods, medicinal stock foods, stock-food tonics, stock powders, condition powders, conditioners, animal regulators, proprietary feeds, proprietary medicines, or any preparations of like nature, are hereby expressly designated as coming under the provisions of this act, and all forms of animal life except man are included under the term "animals." The term "brand," as used in this act, is to be taken to mean: First, the name, trademark, or other designation under which a concentrated feeding stuff is sold; and second, the feeding stuff itself.

Feeding stuffs defined

Condimental feeds

Proprietary medicines

Brand defined

SEC. 2. Every brand of concentrated feeding stuff offered or held for sale within the State of Kansas shall be registered in the office of the director of the Agricultural Experiment Station of the Kansas State Agricultural College, and each sale of any concentrated feeding stuff not so registered shall constitute a separate violation of this act. The manufacturer or seller of any concentrated feeding stuff shall apply to the said director of the Experiment Station for registration and analysis of the feeding stuff, and in his application for such registration and analysis he shall submit a statement of the several ingredients used in preparing the concentrated feeding stuff and the sources from which they were obtained, which information shall be filed for reference, but shall not be disclosed by the said director if none of the ingredients are unwholesome, deleterious, or fraudulent. If the feeding stuff, as described by the manufacturer or seller, is found to consist of wholesome materials, and the name or brand used to designate it is not false or misleading, the said director of the Experiment Station shall register the name, brand, or other designation of the concen-

Registration required

Statement of ingredients required

Registration required annually

trated feeding stuff, its guaranteed composition in the terms stated in this section, and the name and address of the manufacturer or seller applying for the registration. Such registration shall be made annually, and the manufacturer or seller shall pay a registration fee of ten dollars for each brand of concentrated feeding stuff registered; provided, that any manufacturer of condimental or medicinal stock foods shall pay a registration fee of fifty dollars for each brand selling for more than forty dollars per ton.

Amount of fee

SEC. 3. Whenever requested by the said director of the Experiment Station it shall be the duty of the manufacturer or seller who secured registration of a brand of concentrated feeding stuff to furnish said director a true and complete list of the names and places of business of all dealers in said brand of concentrated feeding stuff who purchased it of the said manufacturer or seller and reside within the State of Kansas. Failure to furnish such list shall be sufficient ground for revocation of the registration of said concentrated feeding stuff.

List of dealers to be reported to director

SEC. 4. Every sack, box, carton, or other package of concentrated feeding stuff offered or held for sale or sold within the State of Kansas shall bear a distinctly printed and conspicuous label in the English language, which shall state the name and address of the manufacturer or seller, the registered name, trademark, or other designation of the concentrated feeding stuff, the net weight of the package, and the guaranteed minimum percentage of fat and protein and the maximum percentage of crude fibre.

Label

SEC. 5. In so far as the revenues provided by this act or otherwise may suffice, it shall be the duty of the director of the Experiment Station aforesaid to make, or cause to be made, such inspection and analysis of concentrated feeding stuffs as in his judgment may be deemed necessary to ascertain whether or not manufacturers and others are complying with all the provisions of this act. Towards this end he or his authorized deputies shall procure annually at least one sample of each brand of concentrated feeding stuff registered for sale within the State of Kansas, and shall make or cause to be made an analysis of the same according to the methods of the Association of Official Agricultural Chemists and a certified statement of the results of the analysis shall be prima facie evidence in any legal action within the State of Kansas concerning such concentrated feeding stuff; provided, however, that employees of the State upon salaries shall not receive any additional compensation for making such inspection and analysis.

Inspection and analysis

SEC. 6. In sampling concentrated feeding stuffs in lots of ten or less packages, portions shall be taken from each package; in lots of more than ten packages and not more than five tons, samples shall be taken from not less than ten packages and from not less than ten per cent. of the packages; in lots of over five tons, portions shall be taken from not less than twenty packages. In sampling concentrated feeding stuffs in bulk, not less than ten portions shall be drawn, and these from various parts, so as to represent fairly the whole. The portions drawn shall be carefully mixed, and from the mixture two samples of about two pounds each reserved, and placed in sealed bottles or jars and accurately labeled. One of these samples shall be delivered to the owner of the concentrated feeding stuff or his representative; the other taken for the use of the director of the Experiment Station. Sampling shall be during ordinary business hours, and the owner of the concentrated feeding stuff or his representative may be present, but any refusal by such owner or his representative to permit sampling shall be taken as sufficient evidence of violation of this law by him.

Method of sampling

SEC. 7. Any manufacturer, seller, or holder of concentrated feeding stuffs who shall fail to comply with all the provisions of this act, or who shall sell, offer for sale or hold for sale any concentrated feeding stuffs the composition of which is not in accordance with that guaranteed, upon conviction shall be deemed guilty of a misdemeanor and fined not less than fifty dollars nor more than two hundred dollars and costs of the first offense, and not less than one hundred dollars nor more than five hundred dollars and costs for each subsequent offense; provided, that any seller shall be exempt from the penalty for sale of concentrated feeding stuffs that are below the guaranteed standard if he has a written guaranty from the manufacturer or seller of the concentrated feeding stuff that said feeding stuff is registered and of the guaranteed composition, if said manufacturer or seller is a resident of the State of Kansas. Suit may be brought for the recovery of penalties under the provisions of this act in the district court of the county where the offense is alleged to have been committed, and shall be prosecuted by the county attorney in the name of the State of Kansas, upon complaint of the said director of the Experiment Station or of some reputable citizen of the county. Each sale shall constitute a separate offense. Penalties recovered under this act shall be turned into the school fund of the county wherein the offense was committed. In cases involving the composition of the concentrated feeding stuff a deficiency not greater than one-fifteenth of the guaranteed percentage of any ingredient shall not be taken as evidence of fraudulent intent, but the seller of any concentrated feeding stuff that does not possess the composition guaranteed shall be liable for damages resulting to the user in consequence thereof.

Penalty for violation

Bulletins

SEC. 8. The Experiment Station aforesaid shall publish at least annually a bulletin giving a list of the concentrated feeding stuffs registered for sale in this State, with their guaranteed composition and such other information as may be deemed valuable to the public concerning them and their use. This bulletin shall also contain a list of the manufacturers and sellers of concentrated feeding stuffs in this State, according to the statements secured under the provisions of section 3.

Adulteration

SEC. 9. The adulteration of any concentrated feeding stuff by the addition of foreign mineral matter, or by the addition of foreign animal or vegetable matter of little or no nutritive value, and the use or addition of substances poisonous or deleterious to animals, is forbidden. This section shall not be so construed as to prevent the compounding and sale of balanced feeds or condiments, the composition of which has been duly declared and approved in accordance with the provisions of section 2.

SEC. 10. That original sections 3106, 3109, 3110, 3111, 3112, and 3116 of the General Statutes of 1909 shall be and the same are hereby repealed.

SEC. 11. This act shall take effect and be in force from and after its publication in the statute-book.

Changes in the Law

1. **Proprietary Medicines.**—In section 1 **proprietary medicines** are included under the general term, concentrated feeding stuffs. This will be construed to include only those proprietary medicines given internally.

2. **Label and Guarantee.**—The law does not discriminate, but it would be unfair to require that the weight and guarantee clause of section 4 apply to proprietary medicines for which food value is not claimed and which are not sold by weight.

3. **The Guarantee.**—The maximum percentage of crude fiber must be stated on the label, in addition to the minimum percentage of protein and fat. See section 4.

4. **Tonnage or Inspection Tax.**—This tax has been repealed.

5. **Inspectors.**—The administration of the law has been placed with the director of the Experiment Station and not divided, as under the old law, between the director and the chemist of the Experiment Station.

6. **Feeding Stuffs Exempt.**—No feeding stuff which would properly come under the provisions of section 1 is exempt. Section 1 includes: (*a*) all mixed feeds; (*b*) all feeds in which the composition of the original material has been altered; (*c*) all condimental feeds; (*d*) all proprietary medicines.

Regulations, Feeding Stuffs Law

Regulation 1. All applications for registration must be made on blanks furnished by the director of the Experiment Station. Each application must be accompanied by the necessary registration fee, either draft or money-order, made payable to "Director of Experiment Station."

Regulation 2. Samples of all feeds and proprietary medicines must be sent prepaid with the application for registration. Samples of feeds should not be less than two, nor more than four, pounds. Samples of condimental feeds and proprietary medicines sold in packages should consist of an unbroken package.

Regulation 3. A statement of the label required in section 4 must be submitted with each application for registration.

Regulation 4. If the manufacturer or seller desires that the Experiment Station shall make the analysis to determine the fat, protein, and fiber required in the guarantee, this work will be done at the following rates:

Charge for determining fat, $2.00; protein, $2.00; crude fiber, $4.00; or all three, $5.00.

Regulation 5. The Experiment Station does not guarantee that the analysis made of samples submitted by a manufacturer or seller is representative of the product sold by each manufacturer or seller. The Station merely guarantees that the composition of the sample submitted is as reported. Manufacturers and sellers taking samples for such analysis should be extremely careful to secure a representative sample. Their attention is called to section 6 for directions for taking such samples.

Regulation 6. Manufacturers and sellers are requested to print on their labels (the requirement of section 4) a statement as follows: "Kansas Feeding Stuffs Law Registration No.————." In case packages are already labeled when registered, this statement should be printed on a slip and pasted on the package in a place near the registered name of the article. Compliance with this request will facilitate matters of inspection and identification. No numbers are duplicated. Reference to the feed by this serial number will always identify the goods and will be a protection to the manufacturer or seller.

Regulation 7. All registrations expire on June 30 of each year and should be renewed on or before the first day of July. Registrations made in May and June on new feeds will be credited to June 30 of the succeeding year.

Regulation 8. No provision is made in the law for prorating the registration fee for any portion of a year. The registration is made annually and covers sales made during that fiscal year. It makes no difference whether the sales are made in one week, in one month, or are evenly distributed throughout the year.

Regulation 9. Manufacturers or dealers mixing feed on order are not required to register such mixture unless they subsequently offer the same for sale. This regulation does not apply except when the order is given by the ultimate consumer.

Regulation 10. All correspondence relating to the registration of feeding stuff should be addressed to "Registry Department, Experiment Station, Manhattan, Kansas."

Definitions of Concentrated Feeds

Wheat Bran: The coarse outer coating of the wheat kernel as separated in the usual process of commercial milling from cleaned and scoured wheat.

Bran and Screenings: If to the wheat bran be added, either ground or unground, the various impurities separated from the wheat during the cleaning process and known collectively as *screenings*, the same shall constitute a mixed feed and must be registered, labeled, and sold as *bran and screenings.*

Screenings: The smaller, imperfect grains, weed seeds, and other foreign materials having a feeding value, separated in cleaning the grain. They shall be designated by the name of the grain from which they are derived.

Standard Shorts: The fine particles of the outer bran, the inner or "beewing" bran, germ, and the offal or fibrous material obtained in the last reductions on middlings.

Brown Shorts: As compared with standard shorts this contains mostly fine particles of bran with much less of germ and fibrous offal obtained from the "tail of the mill."

White Shorts: As compared with standard shorts, this bran contains a smaller portion of the bran particles and a much greater portion of germ and fibrous offal from the "tail of the mill."

Mill Run: A mixture consisting of wheat bran and standard shorts combined in the proportions obtained in the usual process of commercial milling.

Wheat Middlings: Differs from standard shorts in that more of the endosperm has been left clinging to the branny particles, i. e., the stock has not been cleaned up so closely.

Shipstuff: (See standard shorts).

Corn bran: The outer coating of the corn kernel as produced in the usual process of commercial milling.

Hominy feed: The bran coating and germ of the corn kernel, and it may contain a part of the starchy portion of the kernel.

Blood Meal is finely ground dried blood.

Meat Meal is finely ground beef scraps. If it bears a name descriptive of its kind, composition, or origin, it must correspond thereto.

Digester Tankage is meat scraps from edible carcasses which have been inspected and passed as satisfactory for human consumption, specially prepared for feeding purposes through tanking under live steam, drying under high heat and suitable grinding.

Registration is not required on any feed composed entirely of ground, cut, or chopped grain kernels from which no portion has been abstracted for the manufacture of other substances, as, e. g.,

Corn chop: Composed wholly of ground, cut, or chopped corn kernels from which no portion has been abstracted for the manufacture of other substances.

Any mixed feed made by combining two or more of the concentrated feeds previously mentioned must be so designated as to indicate all materials used in its manufacture.

Such indefinite terms as "mixed bran" or "mixed shorts" will not be accepted as suitable names for registration.

When the term bran is used without any qualifying word it will be assumed that it refers to *wheat* bran only.

The Purpose of the Law

There can be but one object or purpose in a feeding stuffs law; viz., *the protection of the consumer.*

The consumer is entitled to know what he is buying. The fact that a feed or medicine is registered informs him that it contains nothing harmful if properly used. The declaration of the manufacturer must be true to fact if the feed or medicine is registered. The inspection and analysis at frequent intervals informs the director of the Experiment Station of the reliability of the manufacturer or seller's guarantee. If the feed does not come up to the guarantee, the license to sell is at once revoked. The law also protects the honest manufacturer or seller.

The Law Briefly Stated

1. The law applies to:
    - *a.* All mixed feeds.
    - *b.* All feeds in which the original composition of the material has been altered.
    - *c.* All condimental feeds.
    - *d.* All proprietary medicines.
2. The requirements are:
    - *a.* Registration with the director of the Experiment Station.
    - *b.* The payment of $10.00 annual registration fee on each brand of feeds, and $50 on each brand of condimental feeds selling for more than forty dollars a ton and proprietary medicines.
    - *c.* Filing with the director a statement of ingredients and a list of those handling the feed or medicine in the State.
    - *d.* Placing on every package a label stating:
        1. Name and address of manufacturer or seller.
        2. Registered name, trademark, or designation.
        3. Net weight of package.
        4. Guaranteed minimum percentage of fat and protein.
        5. Guaranteed maximum percentage of crude fiber.

        NOTE.—Provisions 3, 4, and 5 will not be applied to those materials sold as medicines for which no feed value is claimed.
3. Prohibitions are:
    - *a.* Adulteration of feeding stuff by foreign mineral matter or foreign animal or vegetable matter of little or no nutritive value.
    - *b.* The use of poisonous or deleterious substances.

What the Director of the Experiment Station is Required to Do

1. To register all feeds which comply with the provisions of the law on the payment of the proper fee.

2. To determine by examination of the statements submitted by the manufacturer or seller and by analysis whether the feed consists of wholesome materials and whether the name or brand used is not false or misleading.

NOTE.—All printed statements on the package or accompanying it shall be construed to be a part of the name or brand.

3. To cause to be made inspection and analysis of feeding stuffs to determine if the manufacturer and others are complying with the law.

4. To publish annually or oftener a bulletin giving the list of registered feeding stuffs, their composition, and such other information concerning their use as is deemed valuable to the public.

Manhattan, Kansas.
June 17, 1911.

ED. H. WEBSTER,
Director.

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Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 19.

DEPARTMENT OF ENTOMOLOGY AND ZOOLOGY.

T. J. HEADLEE, Entomologist and Zoölogist in Charge.

Burn the Chinch Bug in Winter Quarters.

BY T. J. HEADLEE.

Again the chinch bug[1] has taken up winter quarters in bunch-grass, other clump-forming grasses, and in patches of big blue-stem. In regions in which during the summer the bugs did noticeable damage, those clumps growing along roadsides and fences, in pastures and meadows adjacent to infested fields of corn and sorghums, kafir, milo, cane, etc., are full of bugs, and even those bunches removed by considerable distances will be found to shelter a few. It is, therefore, imperative for the farmer to find out whether his grasses are harboring a dangerous number of bugs. This he can determine in one of two ways, the first being intended to find the bugs if they are numerous and the second to find them if present at all. In using the first method, he should part the stems of the bunch-grass close to the place from which they start. Ordinarily a mulch of soil and decayed grass will have gathered at the base of the stems. He should look carefully in this and should not give up the search at once, because the bugs play possum and are not easily seen until they move. If the bugs are abundant they will be revealed by this search. In using the second method, he should take up clumps of bunch-grass, roots and all, and pick them to pieces over a large sheet of white paper or cloth, watching for the bugs. If they are present in any numbers worth considering, this should reveal them.

WHAT TO DO WITH THEM.

Having found that the bugs are present in considerable numbers, say an average of 50 or more per bunch, the next step is to determine where on the farm these clump-forming grasses are to be found. Then a practicable method of destroying the bug-infested clumps, which will at the same time destroy the bugs, must be selected. Fire at once occurs to one as the most practical and efficient agent to be employed for this purpose. Obviously fire must destroy the bugs in one or both of two ways: First by killing them directly, and second, by destroying their cover and leaving them exposed to the rigors of winter. The first method requires either that sufficient heat shall be generated to effect their destruction or that they shall actually be partly or completely consumed by the fire. The former requires an unusually hot prairie fire, such as might result from the consumption of a heavy cover, while the latter requires close burning—consumption of the stems to within about half an inch of the crown.

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[1] The matter set forth in this circular was sown broadcast in the press of the State during November and December, 1911, and the limited issue of this circular is published mainly for the Station's exchanges.

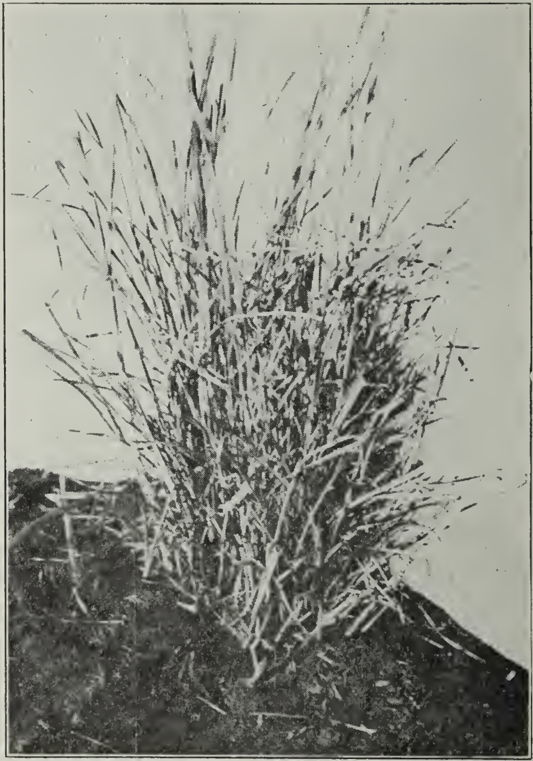

FIG. 1.—Bunch-grass, the winter home of the chinch bug. Burn it.

The prime requisite, then, in firing infested clumps of grass, is so to handle the fire as to make it burn close to the crown from which the stubble grows. The type of firing which gives this desirable result appears to vary with weather conditions and must be selected by the individual farmer at the time of treatment.

The bug-infested grasses should be burned late in the fall or early winter because most of those bugs not killed by the fire per-

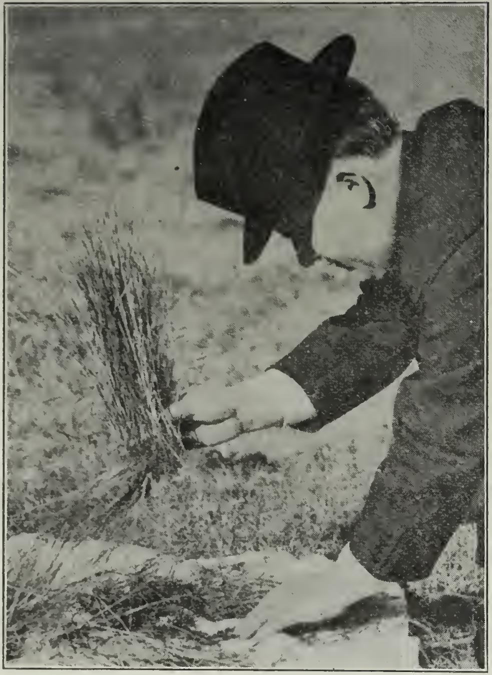

Fig. 3.—In this way you find them if they are present in numbers to bother with.

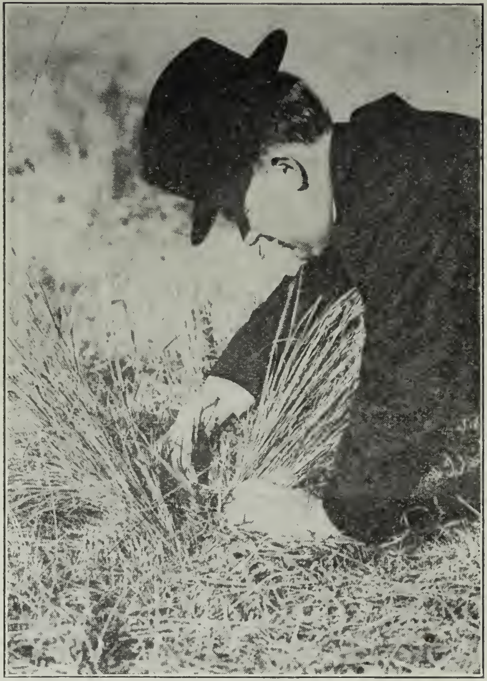

Fig. 2.—In this way you can find the bugs if they are abundant.

ish from exposure, and because, owing to the greater dryness of the grass and consequent more nearly complete consumption, a much larger percentage is destroyed.

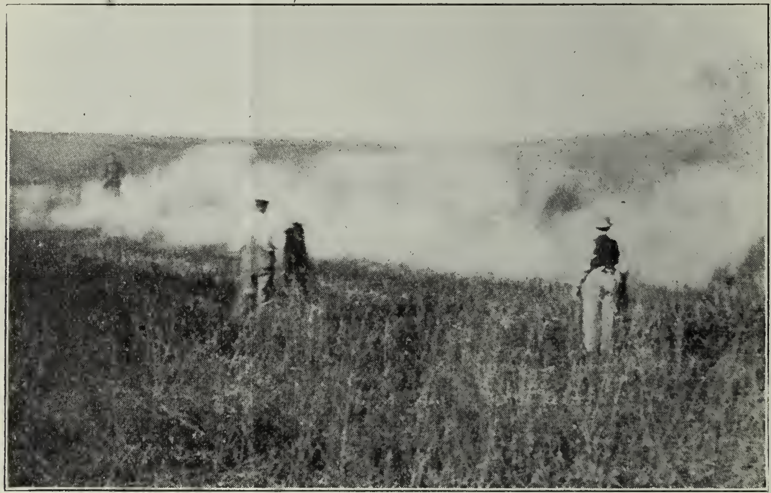

Fig. 4.—What should be done with bug-infested grasses, in waste places, along roadsides and fences, in pastures and mown meadows of native grass.

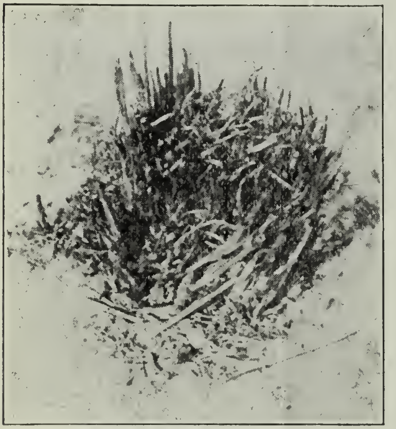

FIG. 5.—The type of burning that kills few bugs—not close enough.

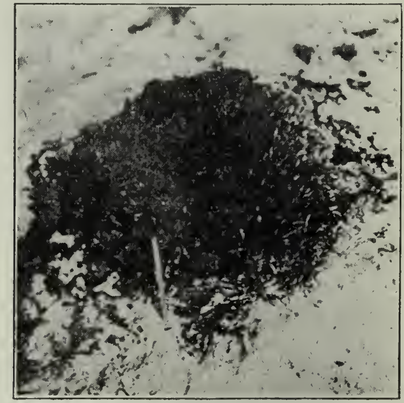

FIG. 6.—The type of burning that kills practically 100 per cent of the bugs.

While burning during 1910 at Conway Springs did not apparently injure the yield of pastures and meadows, burning of such areas each year is not recommended, but where they harbor a menacing number of bugs, they may be burned every third or fourth year. Experiments are now in progress to determine the effect of burning pastures and meadows year after year.

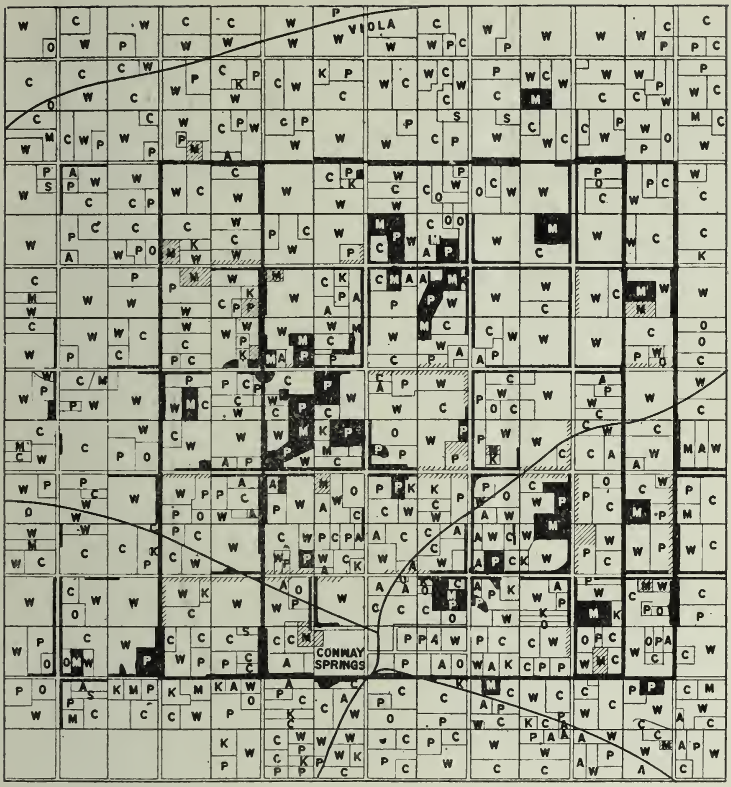

FIG. 7.—Map[1] of burned area and of surrounding territory. The square area surrounded by the strong, black lines is the twenty-five square mile area which was more or less completely burned. The rectangular area surrounded by heavy, black lines is the seventeen and a half square miles of this area that were more completely burned over.

Black parts = burned over; shaded parts = should have been burned but was not; white parts=area without crop and uninfested with chinch bugs; A=Alfalfa; C=Corn; K=Kafir; M = Prairie meadow; O = Oats; P = Prairie pasture; S = Sorghum; W = Wheat.

RECORD OF AVERAGE WINTER MORTALITY IN DIFFERENT TYPES OF COVER.

TYPE OF COVER.	BUGS THAT PERISHED.
Bunch-grass.—As many as 3000 to 4000 bugs per clump, with an average of about 1000	65%
Big Bluestem.—About one-half as many bugs as in the bunch-grass	65%
Corn husks and stalks.—Very few bugs	100%
Dry pieces of manure.—Three to fifty bugs per piece	98%
Osage oranges.—Few bugs	99%
Osage orange tree bark.—Few bugs	100%
Rubbish, leaves, etc.—Few bugs	99%
Turnips.—Five to fifty bugs in each plant	99%

Note.—Bugs found in sorghum were destroyed by plowing under, but there is no reasonable doubt that their fate would have been that of those under the corn stalk cover.

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[1] The boundaries of the fields laid off in this map are only approximate and there may be instances when the crop lettering is incorrect.

RESULTS OF BURNING IN 1910.

For the first time in the history of warfare against the chinch bug in Kansas, the great value of winter burning has been demonstrated in a large, practical way. Last fall, for the purpose of determining the value of this measure, an area of 25 square miles in northern Sumner county was selected. This particular area was chosen because the farmers were willing to coöperate and the bugs were sufficiently numerous for a good test. This area is composed of individual farms of various sizes, and the roadsides, fence rows, pastures, meadows and waste places were covered with a vigorous growth of dry grass, the characteristic feature of which was bunch-grass. In the bunch-grass (*Andropogon scoparius*) everywhere and in the big bluestem (*Andropogon furcatus*) was an enormous number of bugs, the former averaging 1000 per clump. In a strip of fence row 6 feet wide and ½ mile long there were more than 3½ million bugs.

This statement is based on the following facts: (1) clumps of bunch-grass averaged 1000 bugs apiece; (2) clumps of bunch-grass averaged 1 clump per square yard; (3) the big bluestem was widely enough distributed and harbored enough bugs to furnish as many as were found in bunch-grass. In an area half a mile long by 6 feet wide there would be 1760 clumps of bunch-grass. These at the rate of 1000 each would shelter 1,760,000, and the number in bunch-grass plus that in big bluestem makes 3,520,000 bugs.

Of course, a few bugs established winter quarters under all sorts of cover, but these, as the preceding table shows, practically all perished before spring and only those bugs which quartered themselves in bunch-grass and big bluestem survived the winter in sufficient numbers to work serious harm.

During the months of November and December, 1910, a rectangular block, 3½ miles wide by 5 miles long, was stripped of its chinch-bug cover by fire and the remaining 7½ square miles were more or less completely burned.

Although the burning was not as close as was desired, the average length of the stubble being 1.5 inches, whereas it should have been less than 1 inch, an average of 738 bugs out of every thousand present when the firing began were destroyed, and this mortality was raised to 984 per thousand by the first of the following March. Fire supplemented by the winter destroyed 98.4 per cent of the total number that established winter quarters in bunch-grass and big bluestem. There were a few instances where, owing to the attitude of the landowner, or tenant, burning could not be accomplished, and the bugs from these places, together with those from outside the territory and a few from the burned stubs, were the ones found later in the season feeding and reproducing in the burned area. About 65 per cent of all the bugs that started the winter in unburned bunch-grass and big bluestem perished.

LARGER CROP ON BURNED AREA.

From the time the bugs appeared in the wheat in the spring, as an average, they were from 6 to 20 times more numerous in the unburned district than in the burned sections. When the wheat was harvested and the yields figured out, it was found that the yield of the burned area averaged about 2.1 bushels more per acre than that of the unburned, showing that a saving of about $7000 was effected in wheat alone. Oats, being only slightly infested, showed little difference in yield.

In the burned area the reduction of bugs was so great that no corn was killed at harvest time, while in the unburned area from 1 to 40 rows standing adjacent to wheat were sucked dry and completely ruined.

In general, the farmers are well pleased with the results, and one of them, Mr. A. E. Barry, claims that the burning made a thousand dollars for him. The following farmers actively coöperated with us in this test: L. F. Alloway, A. E. Barry, John Beal, Charles Boylan, Lincoln Clark, Henry Dudey, Jesse Duncan, H. E. Ewing, James Grier, Orla Halsey, M. E. Hemphill, J. S. Hedrick, Lewis Hobson, J. A. Jenkins, Edward Lange, David Little, John Marshall, Isaac Mayfield, H. G. Porter, Edward Small, C. A. Stitt, N. N. White, A. A. Wise, Fred J. Wolfe, Thol. Wolfe, Argus Lund, John Crabill, Jefferson Rinehart, L. E. Allyn, T. L. Ellis, John Gould, J. W. Cordell.

CONCLUSIONS.

1. Wherever the chinch bugs did much damage last summer, they have gathered in large numbers in adjacent areas of bunch-grass and big bluestem.

2. Destruction of chinch bug cover in a badly infested area of 25 square miles (a rectangular block of 17½ square miles being almost completely stripped and the remaining 7½ only partly so) during November and December, 1910, gave good results in crops last summer, effecting in the 17½ square mile area a saving of about $7000 on wheat alone, and freeing corn from the usual harvest-time injury.

3. Each farmer should determine whether his bunch-grass and

big bluestem shelter a threatening number of bugs, and if found to do so should strip his farm of bug-infested grasses with fire without delay and get his neighbors to follow his example.

4. To be most effective the burning should be done during the late fall or early winter and should be as close as possible.

Kansas State Agricultural College

EXPERIMENT STATION.—Circular No. 20

DEPARTMENT OF FORESTRY

CHAS. A. SCOTT, State Forester

The Hardy Catalpa.

(*Catalpa speciosa*—Warder.)

INTRODUCTION.

Probably there has been no other tree so generally recommended for planting throughout the State as the hardy catalpa. Many of the plantations that are fifteen years of age or older have made good financial returns, but a large number have scarcely paid for the cost of their establishment and maintenance; still others have been complete failures. The failures have been due to one or more of several factors. However, these failures are usually accounted for by concluding that the wrong kind of catalpas were planted and that the agent from whom the trees were bought was not a reliable man. Such conclusions are very often true, but unfavorable climatic conditions and lack of cultivation account for many more failures.

The proper species is the first factor to be considered in planting. The *Catalpa speciosa* is the only catalpa that is worth planting. It is not an easy matter to be really sure that the seedlings purchased for planting are true to name. This is because the seedlings of all catalpas are so much alike that it is impossible to tell the plants of one species from those of another. This being the case, it is necessary that the selection of planting-stock be made when the different species can be identified with certainty. Fortunately, the characteristics of the seed is one of the best means of identifying the species. The only means by which a planter can be absolutely sure that he is planting the species that he wants, is knowing the seed from which the planting-stock was grown.

Seed that will produce plants true to type can be secured if due care is exercised in selecting the seed-trees. The trees from which seed is to be gathered should be individuals of good form that have made a satisfactory growth and that bear the characteristic markings of the *Catalpa speciosa.*

In the United States there are two native species, the *Catalpa speciosa* (Warder), commonly known as the "hardy catalpa" because of its supposed ability to endure without injury a greater degree of cold than the other species, and the *Catalpa catalpa* (Karst), usually spoken of as the "common catalpa." Both of these species are found attaining to tree size and form in Kansas. The following characteristics will serve to identify these species:

POINTS OF IDENTIFICATION.

Catalpa speciosa.

Seed-pods from seven to twenty inches in length. The walls of the seed-pods are thick and strong, growing singly, in pairs, or occasionally three in a cluster, rarely more than three in a cluster.

Seeds one-third as broad as long. Broad brush of hairs at either end with fringe of hairs extending well along the ventral side.

Bark on old stems deeply furrowed, but never peeling off in scales.

Trunk of trees comparatively straight, seldom dividing into two or more branches of about equal size.

Catalpa catalpa.

Seed-pods from six to eighteen inches in length, walls of seed-pods not thick and strong. Pods quite numerous, from five to fifteen in a cluster.

Seeds fully as long as the seed of the *Catalpa speciosa*, but much narrower, the hairs at either end of the seed forming a narrow brush or pencil, but never extending along the ventral side of the seed.

Bark even on the older stems thin and light, falling off in light scales, never deeply furrowed.

Trunks usually divided into two or more branches of about equal size.

The characteristic markings of the seed are the best means of identification. Only very wide seeds with a broad brush of hairs at either end and a fringe of hairs along the ventral edge should be accepted as pure, hardy catalpa seed.

The hardy catalpa hybridizes readily with the other species and consequently there is danger of getting inferior seed even from the best of trees if any of the other species are growing in the immediate vicinity. Bees and other insects are the means of cross-pollinating the catalpa. The range within which bees and insects work probably does not exceed two miles. If there are no inferior specimens of catalpa growing within two miles of the trees from which the seed is to be gathered, the seed may be considered perfectly true to type.

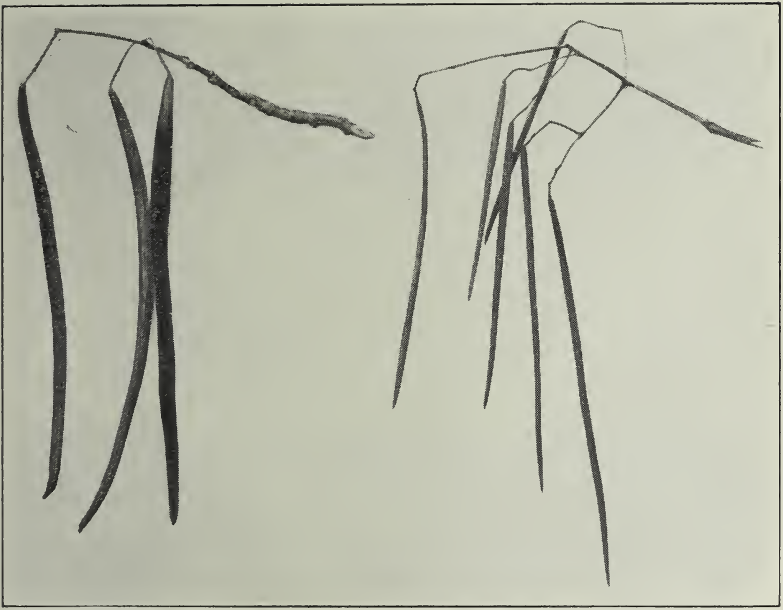
The seed-pods ripen in October. They may be gathered as soon as they are ripe or allowed to hang on the trees until January or February. When the seed-pods are gathered, they should be sacked, and stored in a dry room. Within a few weeks the pods will split open upon the slightest disturbance and discharge the seed. The seeds keep for several months without loss of vitality when stored in a cool, dry place. Trees having a full crown and growing in the open usually produce a large quantity of seeds of high vitality.

METHODS OF PROPAGATION.

The catalpa reproduces readily from the seed and also by sprouts from the stumps of thrifty trees that have been cut. The seeds grow with great vigor when planted under favorable conditions and properly cultivated. The soil in the seed-bed should be made as fine as possible before the seed is sown. The physical condition of the seed-bed soil practically determines the success of the planting. The seed should be sown in broad drills three or four inches in width and one-half inch deep, at the rate of thirty-five to forty seeds per linear foot. The drills should be wide enough apart to allow cultivation by horsepower, three and one-half feet being a very satisfactory distance.

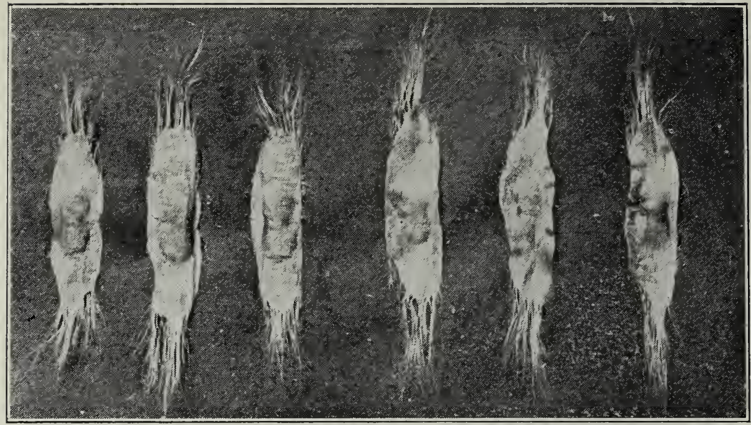
On account of the shape of the seeds and their light weight, it is impossible to sow them with a machine. In practically all nurseries the seed is sown by hand. Covering the seed is an operation that deserves special attention. The customary practice is to cover the seed with about two inches of soil. This is to insure the seed against drying out before it germinates. This amount of covering makes a mound over the drill-row. Under favorable conditions the seeds will germinate in from five to eight days. As soon as the germ has broken through the seed-coat, the mound of earth should then be raked off the drill-row until the soil immediately above the seeds is not over one-half inch deep. Mounding the drill-rows in this way has a three-fold advantage. The first is, that it keeps the catalpa seeds from drying out or perishing before they germinate. The second is, that all of the weed-seed contained in the soil covering the catalpa seed has an opportunity to germinate as quickly as the catalpa seed, and, in leveling the mound above the catalpa seed, the weeds are all killed and the catalpa seedlings come up in a clean, fresh soil. The third advantage is, that if the soil has a tendency to bake and form a crust, raking the mound down also breaks up the crust which may have formed up to the time when the catalpas are practically ready to come through the surface. But under no conditions should the catalpa be expected to grow through more than a half inch of soil. The seeds are small and the germs have not the strength to grow through a greater depth of soil than this.

The seed should not be sown until the ground is thoroughly warm and danger of frost is entirely past. Nothing is gained by early seeding, and often the seeds perish in the ground when a period of cool weather comes immediately after planting. The

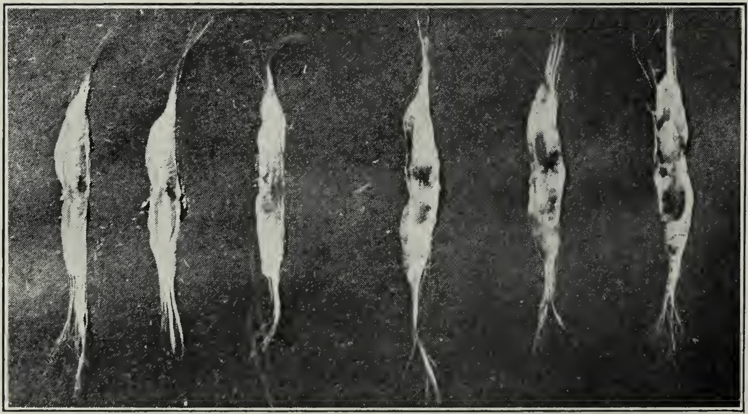


No. 1. No. 2.

No. 1. Characteristic seed pods of the *Catalpa speciosa*.
No. 2. Characteristic seed pods of the *Catalpa catalpa*.



Seed of the hardy catalpa, *Catalpa speciosa*, showing their characteristic form and markings.



Seed of the common catalpa, *Catalpa catalpa*, showing their characteristic form and markings.

plants grow slowly during May and June, and they require extensive cultivation during these months. As the heat of summer comes on, their rate of growth increases, and they reach a height of from fifteen to thirty inches by the end of the growing season.

PLANTING-STOCK.

One-year-old seedlings are the most satisfactory for extensive plantings. At this age the seedlings are strong enough to establish themselves readily in their new location, and to make a good growth the first season. They can also be planted at a much less expense at this age than they can be at the age of two years. The catalpa is very readily transplanted, and with proper care a full stand is easily secured.

In buying or grading seedlings, it is a safe policy to accept only the best. By the best are meant the largest and strongest plants of whatever age is under consideration. In nursery practice the one-year-old seedlings are sorted into three grades according to their size. Grade No. 1 includes the plants ranging in height from eighteen to thirty inches and upwards. Grade No. 2 includes the plants that are from twelve to eighteen inches in height. Grade No. 3 includes all plants under twelve inches in height. The difference in price between the different grades is from one dollar to three dollars per thousand. The No. 1 grade of trees is by far the most desirable and the most satisfactory. Grade No. 2 is quite satisfactory and altogether acceptable for extensive plantings. Grade No. 3 is the culls of the entire lot and should never be accepted in a purchase. In grading home-grown stock they should be rejected, also.

Many of the failures in attempts to grow catalpa trees are due to the planting of cull seedlings. A large per cent of the small-sized seedlings die the first year they are out. The small-sized trees also require more cultivation and care than do the larger plants.

PLANTING-SITE.

The hardy catalpa is exacting in its demands upon the soil. It grows naturally in deep, rich soil along creeks and rivers. Consequently, it reaches its best development in rich, well-drained bottom soils.

It is an entirely safe proposition to plant catalpa trees in any soil that will produce a good corn crop. Catalpa will not make a satisfactory growth in gumbo, poorly drained, or high, dry soils. In selecting a site, all such soils should be carefully avoided.

The catalpa is well adapted for planting on creek and river-valley lands that are subject to inundation. Occasional floodings do not injure the trees unless their tops are submerged. The only time that this condition might occur would be during the first or second year after the trees are planted. The injury would not then be serious unless the trees remained under water for several days at a time.

A general impression regarding the catalpa is that it requires a sandy soil to attain its best development. This is entirely erroneous. The catalpa makes a good growth on sandy loam or on a sandy soil with a loam or clay subsoil, but sandy soils with coarse sand or gravel subsoil is not at all suitable for growing catalpas. In a few instances throughout the State, catalpas have been seen growing successfully on soils entirely too sandy to be used for the growing of agricultural crops. On such land the catalpas attain a height of from eighteen to twenty-four feet, but they seldom afford two lengths of posts. The returns from catalpas on such soils is probably as satisfactory as the returns from any other cultivated crop. However, they are not a profitable, or money-making, crop on such land.

PREPARATION OF PLANTING-SITE.

The first step in setting out a plantation is the preparation of the ground for planting. The catalpa is not a tree that can succeed under adverse conditions, and therefore should be planted only on land that has been under cultivation long enough to have completely killed all grass-sod or bush-growth. To insure a full stand of living trees and a good growth the first year, the ground in which the trees are planted must be in the best possible physical condition. When planted in good mellow soil and given good cultivation, the trees will make a growth of from three to six feet the first summer.

TIME OF PLANTING.

The proper time to set out catalpa trees is at any favorable time between April 1 and May 15. The exact time will vary somewhat with the season. They may be set out as soon as the ground is in good working condition in the spring. It is a serious mistake to delay planting until the buds begin to develop. Growth is in active operation in the development of the leaves and the trees should be planted before growth begins.

Fall planting may be satisfactory in the eastern part of the State, but farther west there is always a risk of losing the trees by winterkilling. Fall planting requires one year more of protection from rabbits.

SPACING.

The distance that catalpa trees should be spaced is a point on which few planters agree. The character of the soil, the annual rainfall, and the care and cultivation that the trees will receive, are factors that must determine the distance of spacing. Six by six feet is the spacing generally recommended. This spacing is quite satisfactory when all of the trees in the plantation are to grow until they are sixteen or eighteen years old. However, if some of the trees are to be cut for posts or other purposes as soon as they are large enough, and these cut promiscuously throughout the plantation, the stand is left so open that grass and weeds soon gain a footing and the trees around the opening develop heavy limbs instead of tall, straight trunks.

The sprouts growing from the stumps of cut-off trees in a plantation seldom grow into satisfactory trees because the shade from the surrounding trees prevents their development. There is, therefore, little hope that a sprout from the stump will grow up to take the place of the tree that was cut.

Too wide spacing allows heavy limbs to develop near the ground and the best form for post or pole production is not thus secured.

Where intensive methods are to be practiced, the trees may be spaced three and one-half by seven feet. By the time the trees are eight or ten years old they will be crowding each other badly, and one-half of them should then be cut out. When the plantation is thinned, the remaining trees are left seven by seven feet, which is sufficient room to permit them to reach full development. Crowding during their early period of growth is entirely beneficial, as it causes the trees to develop clean, straight stems free from heavy limbs. The stems in such dense stands are long and slender, but after the thinning the crowns of the remaining trees develop rapidly, and this is followed by an increased diameter-growth of the stem.

The trees that are cut out at eight or ten years of age are large enough to make one post each and considerable stove wood. The value of the posts and of the fuel will much more than pay for the cost of their production. The three distinct advantages gained by close spacing, three and one-half by seven feet, are:

1. The crowding of the young trees develops the best possible form.

2. The dense shade keeps out grass and weeds and reduces the amount of required cultivation.

3. The litter falling from the trees provides a mulch that protects the soil and retains the moisture.

CULTIVATION AND CARE OF PLANTATION.

Whatever spacing distance is decided upon, it should be such as to allow clean cultivation with the implements used in cultivating the other crops grown on the farm. It is quite a common practice to grow a row of corn between the rows of trees the first year. The corn usually more than pays for the cost of cultivating the trees and thus reduces the cost of producing the crop of timber.

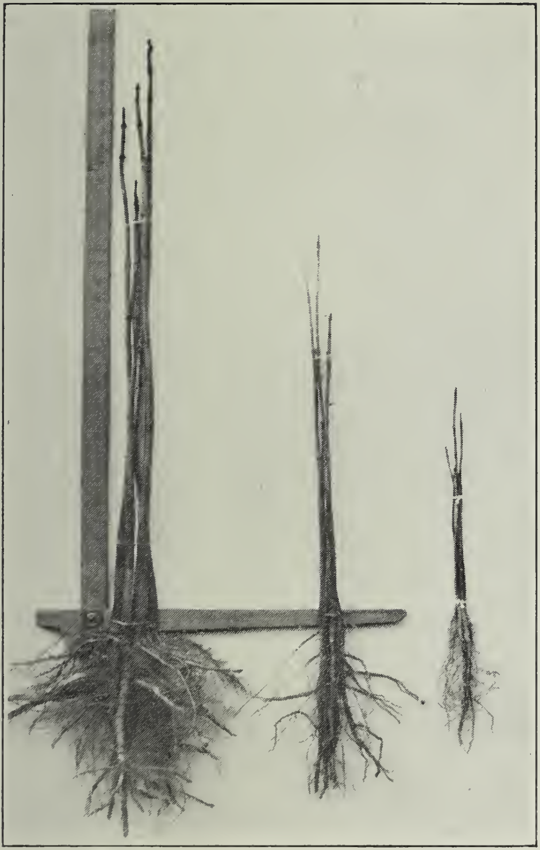
Thorough cultivation is very necessary in a newly established catalpa plantation. Like any other tree that has been transplanted, the catalpa is set in its new location with less than one-fourth of its root system to gather moisture and to nourish it until new roots can be grown. Under these conditions, the young trees require the best of treatment if they are to succeed. Trees respond to good cultivation as readily as any other cultivated crop, and the start they get the first season is distinctly noticeable for several years. The catalpa is a tree that comes into leaf very late in the spring and it is one of the very first to lose its leaves in the fall.

Cultivation is, therefore, very necessary to keep grass and weeds from gaining a foothold. A sod of grass is as injurious as a growth of weeds, or even worse. The cultivation must be continued until the trees reach sufficient growth to shade the ground completely. This growth will probably be attained during the third year.

The only care that the trees will require after cultivation ceases is protection against injury by fire or live stock. The danger of injury by fire is not great unless there is a growth of grass or weeds on the ground; the litter from the trees does not accumulate in sufficient abundance to carry destructive fires. Live stock of any kind is harmful to trees if the stock is given freedom to range in the plantation. Cattle, horses, and sheep are especially harmful on account of trampling and packing the soil about the trees. Trees demand a loose, friable soil and any treatment that compacts the soil is detrimental to their growth and development.

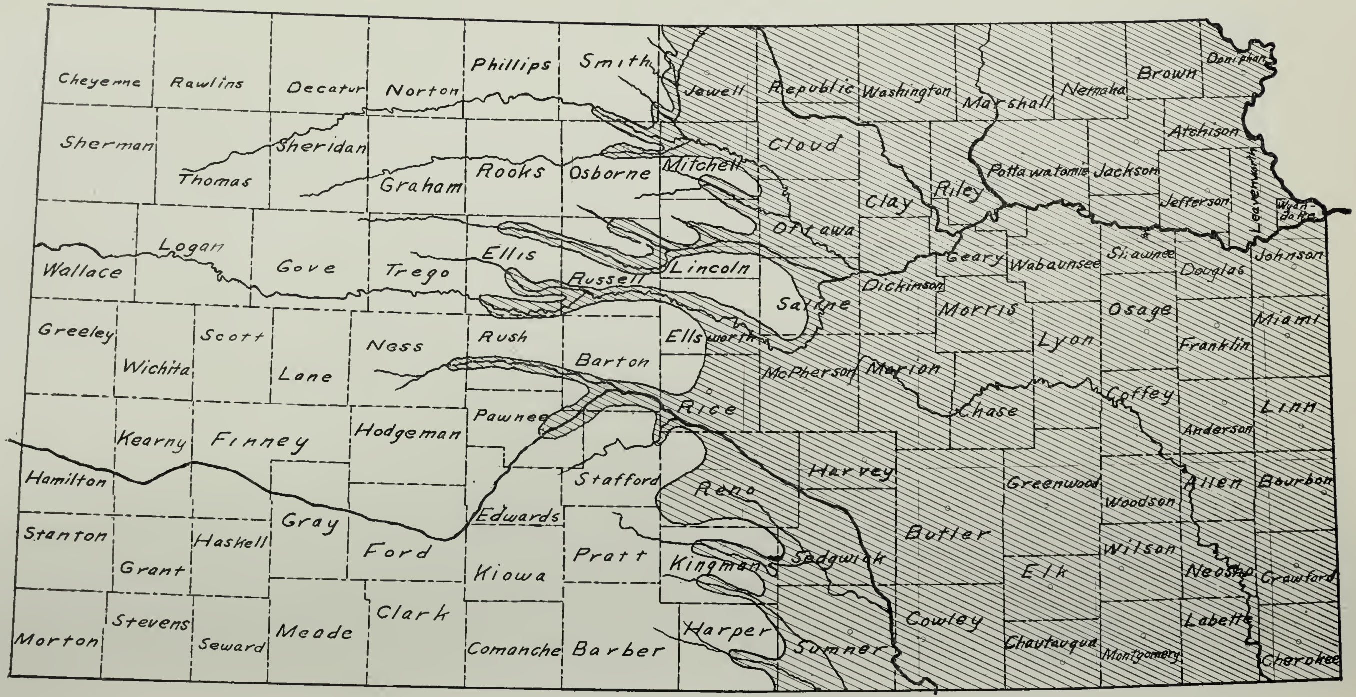
PROTECTION AGAINST RABBITS.

The rabbits are the most destructive enemies that young catalpa trees have. They are particularly fond of the bark of the one- and two-year-old trees. There are several methods of protecting the young catalpas against rabbits. In small plantations where there are but a few hundred trees to be protected, a simple and



No. 1. No. 2. No. 3.

Grades of catalpa seedlings. Grade No. 1 consists of plants exceeding 18 inches in height. Grade No. 2 consists of plants between 12 and 18 inches in height. Grade No. 3 consists of plants under 12 inches in height.



Shaded portion shows region in which catalpas can be grown successfully in Kansas.

effective method is to wrap the stems with a tree shield, which is a strip of wood veneer fitting closely around the stem and held in place with a wire tie. Building-paper cut into strips, wrapped around the stems, and tied in the same manner gives perfect protection.

Another method of protection that has proved successful where tried is that of inclosing the young plantation with a woven-wire, rabbit-tight fence. Rabbits will seldom go over a thirty-inch woven-wire fence, but they will crawl under if the wire is not in close contact with the ground.

Poisoning has in some instances proved a very efficient method of protecting trees against injuries by rabbits. There are two general methods used; the first is to place poisoned water in the rabbit runs, especially during periods of dry weather. The second method is that of placing poisoned food where the rabbits can get it. Rabbits are fond of practically all kinds of vegetables and some fruits; any of these may be used for this purpose. The Ohio Experiment Station has had good results in destroying rabbits by dipping twigs of trees in a solution of one part of sulphate of strychnine, one part of borax, one part of white syrup, and ten parts of water. This mixture should be well shaken before the twigs are dipped in it. They are then scattered where the rabbits will find them.

Washes of various sorts have frequently been recommended for the protection of orchard trees against rabbits. The same can be used with equally good results on the catalpas. The following is recommended by the Oklahoma Agricultural Station and has been found very satisfactory: One gallon of water, two pounds of soap, two to four ounces of carbolic acid. Some prefer to add enough vermilion to make the mixture a pinkish color. This wash is painted on trees in the fall with a brush or a swab of rags tied to a stick. Another wash which is used by the same station, and which has proved very satisfactory, is made by slacking a peck of fresh lime with soapsuds, after thinning to the consistency of whitewash and adding half a gallon of crude carbolic acid, four pounds of sulphur, and one gallon of soft soap. Paint the trunks of the trees in the autumn in the manner heretofore prescribed. The United States Department of Agriculture recommends the lime-sulphur wash as having given thoroughly satisfactory results. This wash consists of twenty pounds of unslacked lime, fifteen pounds of flowers of sulphur, fifty gallons of water. The lime, the sulphur, and one-third of the water are boiled together for one hour, and then the rest of the water is added. If salt is added the wash will stick better.

Various methods of trapping have proved satisfactory. A trap made of a half barrel sunk into the ground with a balanced swinging lid slightly smaller than the top of the barrel on which bait has been placed is quite satisfactory. When the rabbit steps on the lid, it tips and allows the rabbit to drop into the barrel. Another ingenious trap is made of a small, rectangular box with a door in one end held open by a trigger. The rabbit readily enters the box and, in moving around, releases the trigger and closes the door. The objectionable feature about this trap is that but one rabbit can be caught at a time.

One of the most effective methods of protection against injury by rabbits is clean cultivation. If food is available elsewhere, rabbits seldom frequent places where they cannot find cover. In one plantation observed for three years, in which plantation the trees were given clean cultivation, and in which there was not a weed or vegetation of any character to afford cover, not a single tree was injured by the rabbits. In another plantation not half a mile from the one mentioned above, in which there was abundance of cover, the rabbits were numerous. After four years' work in attempting to get a stand of trees, the plantation was abandoned because of the injury done by the rabbits; at the end of the four years' trial, not over fifteen per cent. of the trees showed more than a one-year-old stem. The conditions in the two plantations were very similar except for the amount of cover for the rabbits.

The best method of protecting plantations against rabbits will depend entirely on local conditions, including the area of the plantation and the amount of injury that rabbits will probably do. However, it is unsafe to set out a plantation of catalpas without preparing to protect them, in some way, against rabbits.

CUTTING BACK.

Some catalpa growers practice and advise cutting the trees back to stumps level with the ground two years after the trees are set out. This is to secure a perfectly straight growth to the height to which the sprout will grow the first season after it is cut back. When cut back in this way, the stumps sprout freely, and, if they are properly cared for, trees of very satisfactory growth and form can be developed. However, cutting back necessitates a great deal of work that farmers seldom have time to do, and any advantage that may be gained hardly pays for the extra cost of such treatment.

If cutting back is to practiced, the trees should be cut after they have grown two years in the permanent plantation. The stumps will send out three or four sprouts, all of which must be cut off except the strongest. Under favorable conditions this one sprout will attain a height of from six to ten feet the first season, and by the end of the second season will be as tall as the five-year-old trees that were not cut back. If one trimming of the stump-growth would answer all needs, the care of the sprout-growth would be a simple matter, but the stumps persist in sprouting, and the plantation must usually be gone over two or three times to keep the stumps free of undesirable sprouts.

On account of the excessive growth and the heavy foliage, the one-year-old sprouts are subject to considerable injury from wind-felling. The strain caused by a heavy wind splits the sprouts from the stump. Danger from such injury is entirely overcome during the second season's growth.

FORM AND SIZE.

In Kansas the hardy catalpa is a medium-sized tree which, when planted in groves, reaches its best financial development in from eighteen to twenty years. Trees in single rows, as in street and roadside planting, require a much longer time to reach their full development.

When closely planted in groves, the trees develop a tall, slender trunk with very few large side branches. Trees from eighteen to twenty years old vary from thirty to forty feet in height and from eight to ten inches in diameter at one foot from the ground, depending upon the strength of the soil in which they grow. The stems are reasonably straight and entirely satisfactory for fence-post purposes. The trees hold their diameter well and will usually cut three lengths of six and one-half foot posts. The catalpa is preëminently a fence-post tree; in its seedling stage it continues to grow throughout the season until checked by frost; consequently, from six inches to a foot of tender, immature wood at the end of the season's growth winterkills. The following season's growth starts from a bud somewhere on the stem below the injured portion. This causes a slight crookedness in the stem that is objectionable where a perfectly straight stick is desired. Pole size is not reached until the trees are twenty-five years of age or older, and it is only under the very best of care that they can be grown to this size without becoming infected with fungi.

FUNGUS DISEASE.

The catalpas throughout the State are susceptible to the attacks of a fungus disease, *Polystictus versicolor*,[1] which very generally attacks the trees in groves after they are past twenty years of age. In some plantations the trees are attacked at an earlier age; the fungus gains entrance through wounds in those lower limbs which are killed by the shade from the upper part of the tree. The disease spreads from the point of entrance, going both up and down the trunk. Within a very few years after the disease gains entrance, the wood of the entire trunk is affected and the tree dies. The presence of this fungus is easily detected by the occurrence of brackets or punks, often spoken of as "toadstools," that appear on the surface of the infected parts, and also by the occurrence of broken limbs. In an advanced stage of the disease, the trunks of the trees are usually covered with a growth of brackets which are the fruiting organs of the fungus. The infected trees are often broken off by the wind at heights varying from two to ten feet from the ground.

The fungus destroys the strength of the wood and makes it worthless for any purpose. The only possible way of preventing injury by this trouble in a grove of catalpas is to cut the trees before the disease has developed to the point of seriously affecting the strength of the wood.

LENGTH OF ROTATION FOR THE CATALPA.

A careful study of catalpa plantations indicates that the catalpa must be handled on a sixteen- or eighteen-year rotation. At this age the trees are large enough to cut three lengths of posts that are large enough for general fencing purposes. The trees do not reach their full growth or development at this age, but the risk of losing the crop by an attack of the fungus heretofore mentioned is very great, and the increased value of larger material does not balance the risk.

SECOND CROP.

If the trees are cut while they are in a good, thrifty condition, the sprouts from the stumps will yield a second crop of posts in from fourteen to sixteen years. This second crop of posts will nearly equal the first cutting in number and value. They will be straighter and freer from limbs than the posts of the first cutting, and quite as durable.

The care of the plantation during the production of the second

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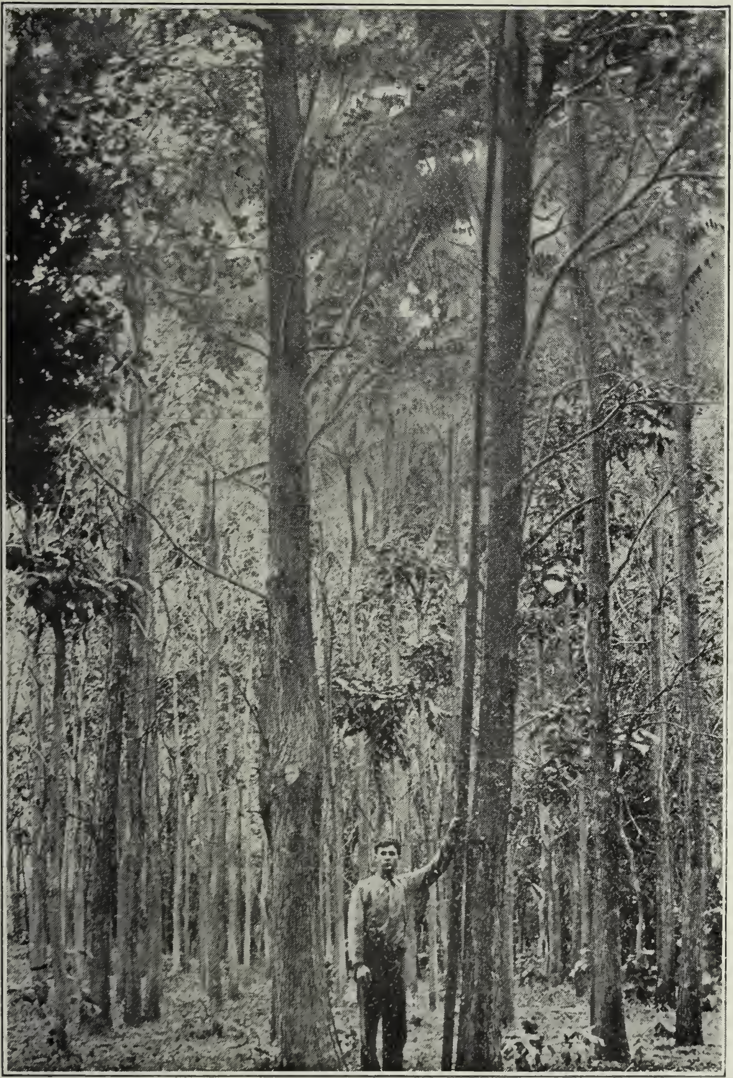
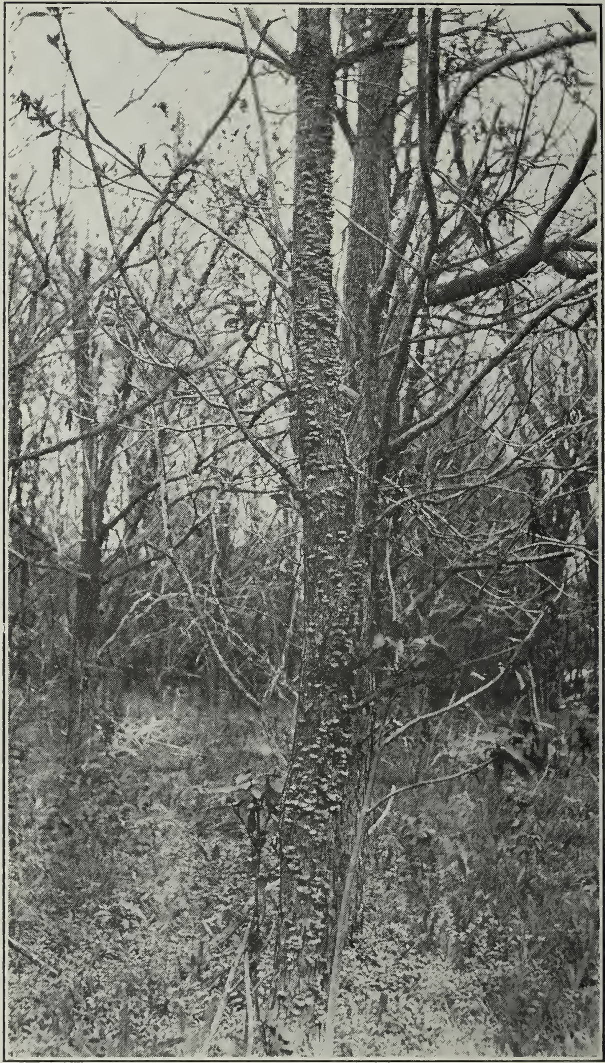
[1] Described in Bulletin 37 of the Forest Service, U. S. Dept. of Agri.



A twenty-seven year old hardy catalpa plantation on Mr. Geo. Newcomb's farm near Morrowville, Washington county, Kansas. The measuring board is 20 feet in length.



A catalpa tree infested with the fungus disease Polystictus versicolor. The sporophores or fruiting bodies appear on the surface of the bark.

crop is more simple than that of the first. To secure a good growth of sprouts the trees should be cut in March or early in April. The stumps should be cut smooth, with the slant all in one direction. In May each living stump will develop from ten to twenty sprouts that will grow very vigorously and that by the middle of June will begin to be thrown by the wind. Later in the season many of the sprouts become top-heavy and fall of their own weight, breaking at the point of union with the parent stump. In plantations where the sprout-growth is rank, the loss due to the sprouts falling of their own weight or being felled by the wind is very heavy in the first summer. During the second season's growth the union of the sprout with the stump develops sufficiently to withstand all ordinary strain.

There are two methods that have proved entirely satisfactory in handling the sprouts. The first method is to allow all the sprouts to grow untouched until the summer of the second year's growth. At this time all but one or two of the largest sprouts are cut off close to the stump. This method has been practiced extensively with good results.

The second method of handling the sprout-growth is to go over the plantation as soon as the sprouts reach a height of two or three feet, select three or four of the largest arising from each stump, and tie these together loosely with a band of binding twine. The tops of all the other sprouts are then broken off to retard their height growth. When the sprouts selected are bound together, each helps support the other and reduces the loss from wind-felling to a minimum. By midsummer, it is necessary to go over the plantation a second time to bind the sprouts again and break off the tops of the undesirable ones. The second band should be placed as near the tops of the sprouts as possible, in order to hold the stems from falling apart of their own weight. During the summer of the second year, all the sprouts are cut off close at the stump, except those that are selected for the future trees.

There are three advantages in the practice of allowing all the sprouts to grow until the second year before cutting them off. First, the full growth shades the ground and prevents a growth of weeds that would practically smother the sprouts. In every plantation that has been studied, a rank growth of sunflowers and horseweeds has grown up during the summer following the cutting. In several plantations the growth of weeds exceeded the growth of the catalpa sprouts. Wherever this occurred, the catalpas were seriously injured. In attempting to reach up into the light, they grew too slender, and were unable to support the weight of their own leaves.

Second, a full growth of sprouts greatly lessens the loss from attacks of rabbits. The protection of the sprouts against the rabbits is a very important item in caring for a grove. When all the sprouts are allowed to stand over the first winter, the rabbits feed on the smaller stems, and the larger stems often go through the entire winter untouched.

Third, when a full growth of sprouts is permitted the first season, the cost of sprouting the stumps is reduced to a minimum. One cutting of the sprouts during the second season's growth is all that is required. The second growth of sprouts that appears after this cutting gradually fails on account of lack of light. The dead stems are unsightly for a year or two, but they in no way interfere with the growth of the second crop of trees.

The method of selecting the future tree early in the first season and cutting off all the other sprouts—which method has been frequently advised—is not practical. The loss by wind-felling of the sprouts thus selected is excessive. Success in growing catalpas is determined largely by the cost of the labor expended upon them. The very least amount of labor that will produce the desired growth is the watchword that must be constantly kept in mind. Successive sprouting is a waste of time as well as an unwarranted expense that must be charged against the cost of growing the crop.

Whenever cultivation is possible, the ground between the rows of trees should be cultivated during the summer immediately following the cutting. A disk harrow is the most satisfactory implement for such cultivation. The cultivation at this time is very necessary to keep down the weeds that would otherwise take possession of the ground. Cultivation that keeps the surface soil in good physical condition greatly increases the rate of tree-growth. On the other hand, a lack of cultivation results in a heavy growth of weeds, which, after they ripen, afford the greatest kind of cover and protection for rabbits, which in turn live on catalpa bark throughout the winter, girdling and injuring many valuable trees. The presence of the dry weeds also increases the danger of the destruction of the trees by fire. If a fire should once get started in such a mass of dry vegetation, it would be impossible to stop its progress until it burned itself out. The cultivation prescribed would cut and injure some of the surface roots, but this injury is not worthy of mention in comparison with the injury that would result from a fire running through the trees.

If the trees of the original planting are allowed to grow until they become infected with fungus, their ability to reproduce by stump sprouts is seriously impaired, and a second crop is very uncertain.

CUTTING.

A second crop of posts from the stumps must always be considered in connection with the cutting. To secure the best second growth, the trees should be cut late in the winter or early spring; March is a very desirable month. The stumps should be cut low so as to insure a sprout-growth from as near the surface of the ground as possible. A smooth stump with the slope all in one direction is desirable to avoid pockets that will hold rain or snow water and will thereby induce fungus attacks.

SEASONING.

The value of thoroughly seasoning the catalpa posts before setting them cannot be overestimated. To air-dry posts and poles thoroughly will require from six to nine months' time, depending upon the season and also upon the size of the posts.

The seasoning can be most quickly and satisfactorily accomplished by piling the posts in an open pile in alternating tiers of three and seven posts each. This order of piling admits of abundance of light and free circulation of air. The bark of the catalpa is very thin and does not seriously interfere with the seasoning of the posts. It clings tightly to the seasoned wood and is not detrimental or objectionable on the post.

The value of thoroughly seasoning posts or poles before setting them is that drying the wood increases its durability. Bacteria and fungi that cause decay can exist and develop only in a moist medium. Therefore, if the wood is dried before it is set in the ground, it greatly lessens the opportunity for fungi to attack it.

DURABILITY AND CHARACTER OF CATALPA WOOD.

The catalpa wood, wherever known, is recognized as one of the very durable woods, second only to the Osage orange and the red cedar. In spite of its reputation for durability, some complaints have been received to the effect that the posts are short-lived and not satisfactory. An investigation of several such unfavorable criticisms regarding the value of the posts has led to the following conclusions:

First, the posts were set before they had been seasoned; or

Second, the trees were infected with fungi and the strength and durability of the wood were seriously impaired before the trees were cut.

When the trees are cut while they are in a perfectly healthy condition, whatever their age, and the posts thoroughly seasoned before they are set, the wood is very durable and satisfactory for fence-post purposes. The wood is light, but strong enough to resist the required strain of the fence, and it holds staples very satisfactorily. The posts are clean, smooth, pleasing in appearance, and easily handled.

In general repair work on the farm, the catalpa is a very serviceable wood. It has been used with entire satisfaction for sweeps on horsepowers, for tongues of all sorts of implements and vehicles, and for doubletrees, singletrees, and neckyokes.

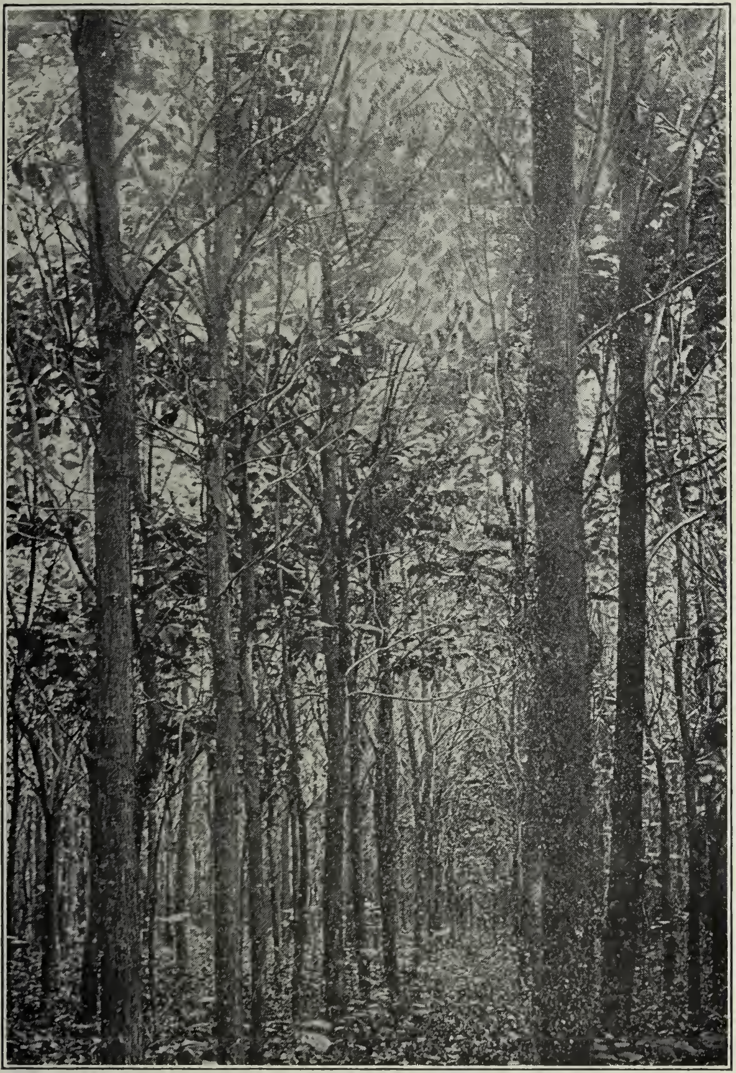
RANGE OF SUCCESSFUL GROWTH.

The hardy catalpa is an introduced tree in this State, its natural range being throughout southern Ohio, Indiana, Illinois, eastern Missouri, and southward. The range for growing the catalpa on a commercial scale in Kansas is confined to the eastern half of the State. To draw a line defining the western limit of successful groves of catalpa, the line between Jewell and Smith counties projected south to the southern boundary of the State is a safe division. West of this line the catalpa can be grown successfully only in favored sites on low ground along the water courses. Under no consideration should the catalpa be planted on the high prairie land of western Kansas. It cannot endure the dry summers and prevailing wind of that section of the State.

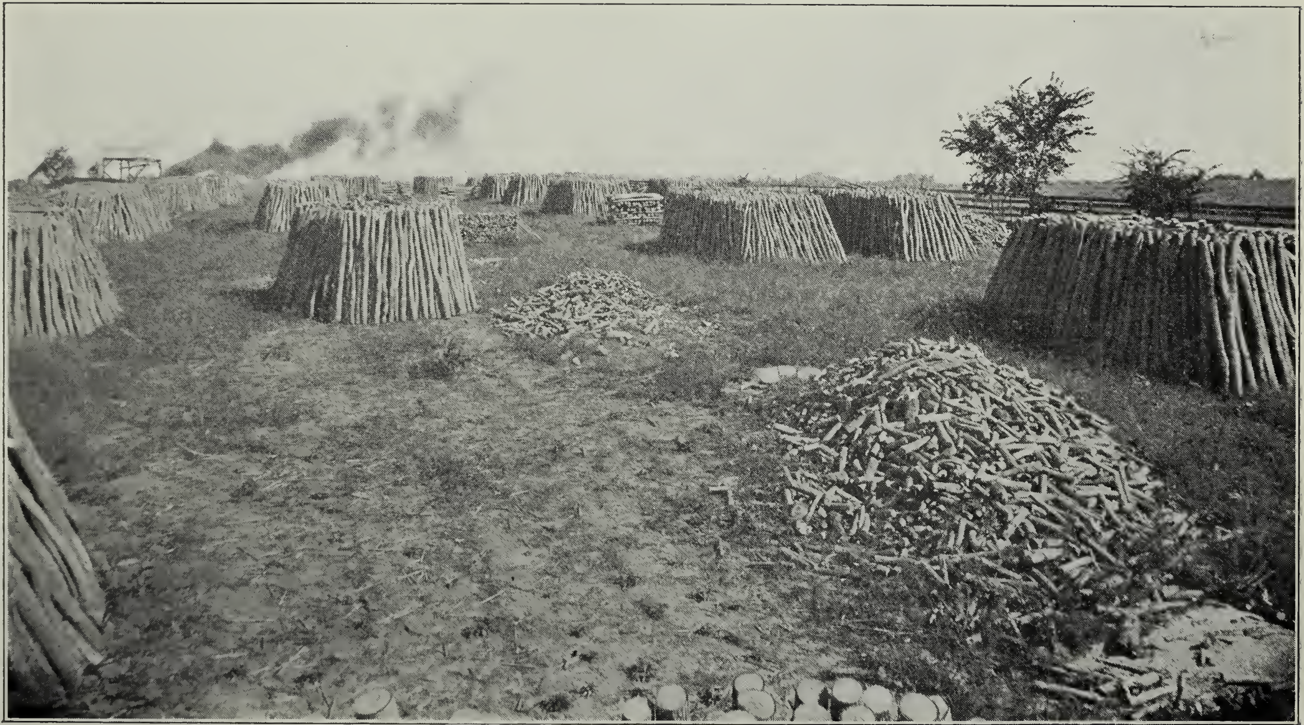
CATALPA GROWING AS A COMMERCIAL ENTERPRISE.

The possibility of growing catalpas on a commercial scale is receiving considerable attention throughout the State, especially in the southern part. The plantations within the State that have received proper treatment have without exception proved good financial investments, and without exception the owner of the plantations are enthusiastic catalpa men.

The commercial product of a catalpa plantation is posts and poles. The market for the products is good and will continue to be good, as the demand for posts and poles is increasing and the supply of natural timber suitable for such uses is diminishing. As the supply from the natural sources decreases, the demands on the artificial plantations will increase. In this State the catalpa is practically without a competitor. As a tree, it is easily handled and grows into commercial size in a comparatively short time. When cut, it makes the most desirable post on the market. Geographically, Kansas is ideally situated to make the growing of



Eight-year-old second-growth hardy catalpas from 21-year-old stumps in the Farlington Plantation, Crawford county, Kansas.



Yard containing 60,000 posts and 650 ricks of stove wood cut from 20 acres of 16-year-old hardy catalpa trees.

catalpa posts and poles an important industry. The demand for the posts comes largely from the plains region lying farther south and west. The Kansas plantations are nearer the field of consumption than is any other source of supply. This shortens the distance that the products must be hauled, and saves immensely in cost of transportation. The lightness of the wood is another factor favoring the catalpa. The air-dried wood weighs only about half as much as the same volume of Osage orange, its closest competitor. The uniform size and smoothness of the catalpa posts allow them to pack closely in the car. In the range country the posts are frequently hauled long distances, again the lightness ness of the posts and the compactness of the load are a big factor. On average country roads a team can easily haul from 250 to 300 posts at a single load.

In considering the possibilities of growing the catalpas on a commercial scale, the first point to get absolutely clear is that the land selected is suitable for their thrifty growth and within reasonable distance from a shipping point. If the land is on or near a main line of road, so much the better.

In selecting the planting-stock, great care must be exercised to be sure of getting the *Catalpa speciosa*. The common catalpa is not worth planting and will be a source of endless grief. The distinction between the two species is most clearly seen in the mature trees; indeed, it is only from the characteristics of the mature trees or of the seeds that the species can be definitely determined. The desirable trees should be marked for their seed crop. The seedlings are easily and cheaply grown; if the planter requires several thousand, he can well afford to grow them himself. In case he buys his seedlings, he should buy only from reliable nurserymen who make a specialty of catalpas and who sell them at a figure that will allow the planter an opportunity to grow them at a profit.

Before setting out to plant and grow catalpas on a commercial scale, the prospective grower should clearly understand that the investment is a long-time one, that it will be ten years before there are any returns from the planting and at least fourteen or sixteen years before the entire crop can be cut and marketed. In view of this fact, the original cost of the establishment of the plantation will practically determine the financial success or failure of the undertaking. The rule of compound interest must be applied in such investments. Five per cent. compound interest is a very reasonable rate to require of such an investment. On this basis, if $1 is put out at five per cent. compound interest, it will in sixteen years amount to $2.18. To determine the future worth of the investment, multiply the cost per acre by 2.18. The result will be the value of the investment at the end of sixteen years at five per cent. compound interest. Take a concrete example: If the trees are planted at three and one-half by seven feet, 1777 will be required to the acre. At $5 a thousand, the cost will be $8.88 an acre. Preparing the ground, planting, and cultivating the trees for two years will cost at least $12 an acre. At five per cent. compound interest, this will, at the end of sixteen years, amount to $45.52. To this must be added the cost of harvesting and rent on the land. This cost will vary, depending upon the amount of material to be cut and the cost of labor; however, it is a safe estimate to say that it will cost $70 an acre to cut and market the crop. Suppose the land on which the trees are to be grown will rent for $5 an acre per year; in sixteen years this will amount to $80. This makes the total cost of the crop of timber $195.52 an acre. In other words, under the conditions assumed above, a plantation must produce a yield worth $195.52 an acre or you cannot afford to grow the trees.

The cost of preparing the ground, planting and cultivating the trees, the rent of the land, and the cost of harvesting and marketing the crop are items that will remain the same regardless of the cost of the planting-stock. In the foregoing estimate, this cost is $167.16 an acre. But inasmuch as the cost of the trees is often the determining factor in the establishment of a plantation, let us consider the difference in the final results. In lots of 10,000 and more, the catalpa seedlings can be grown at home for $2.50 a thousand. Nursery-grown trees can be bought in lots of 10,000 and more for $5 a thousand and upwards, while certain nurseries are flooding the State with agents selling catalpa seedlings at $25 a thousand. The following table shows the difference that a few dollars in the initial cost makes in the final cost:

Table showing future value of cost of catalpa planting-stock for one acre, on basis of 1777 trees to the acre, and estimate of total cost per acre.

COST OF TREES PER M.	Present Worth per Acre..............	Value of Investment in 16 Years.....	Estimated Cost of Preparing Ground, Planting, Cultivating, Rent on Land, Harvesting, and Marketing the Crop.	Total Cost of Crop per Acre...........
$ 2 50.......	$ 4 44	$ 9 67	$ 176 16	$186 83
5 00.......	8 88	19 35	176 16	195 51
10 00.......	17 77	38 73	176 16	214 84
25 00.......	44 42	96 83	176 16	272 99

The foregoing figures tell their own story, which is simply this: At a reasonable price for the planting-stock, catalpas can be grown at a profit; but if the price exceeds $10 a thousand, it is very doubtful if they can be grown profitably.

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Kansas State Agricultural College

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A Circular Explaining the Relation Between the Quality of Butter and Prices Paid for Butter Fat

Poor Cream Loses Money for the Farmer

During the year 1911, Kansas dairymen and creamery men suffered a loss amounting to not less than one million dollars as a result of low prices paid for butter fat and received for butter. This loss was caused directly by the average quality of cream produced. Since the creameries could not make from this cream butter which would bring the highest possible price, they could not pay the highest price for butter fat. It must be said to the credit of the Kansas creameries that they employ the latest improved and most scientific methods of butter-making and are able to make the best butter possible from the cream received. For these reasons and by superior sales methods they have given Kansas butter a satisfactory commercial standing and are netting the farmers better prices for butter fat than the same quality of cream would return if factory conditions were less highly developed. The burden of the million-dollar loss was sustained by the cream patrons, especially by those delivering the best cream; for their cream went into the same can with poor cream, and thus the best quality was brought down almost to the general average of the poor cream.

Relation of Butter Fat Prices to Butter Prices

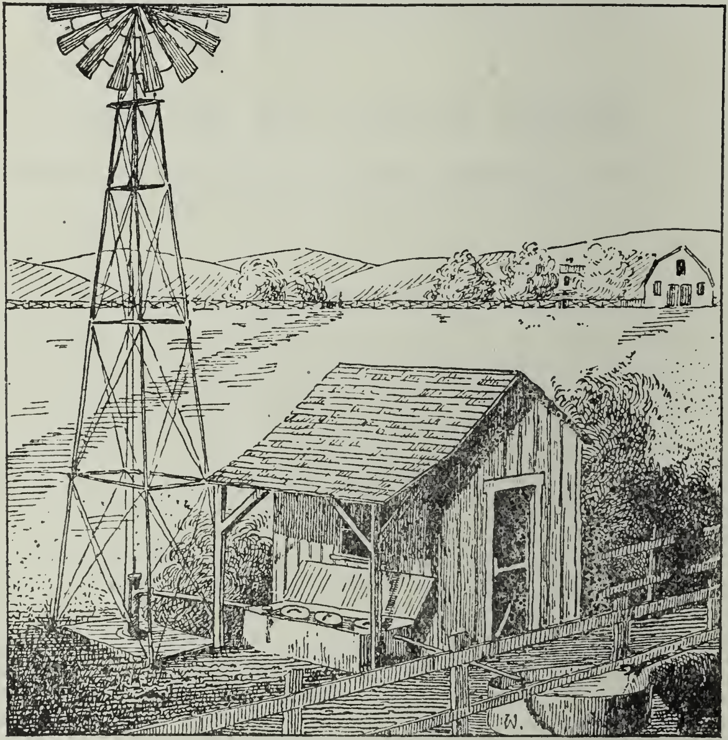
The market quotations which the farmer generally reads are those for the highest grades of butter. The Elgin market deals chiefly with the best quality of butter obtainable, but a small per cent. only of all of the butter made comes up to the required standard of excellence. As a result, the prices paid for butter fat have generally been from two to five cents lower than the quotations for the best butter on the principal wholesale markets.

Better Butter Will Bring More Money to the Farmers

The production of more high-grade cream will not only result in better butter, which will bring a better price, but will create a further demand for Kansas butter and call the attention of the public to Kansas dairy products in general. To attract attention to the product of any locality invariably results in a greater demand for that product. Furthermore, if better butter can be made when prices are generally low, this butter will be in strong demand for storage purposes in the late spring and summer and will thus result in higher prices for cream when the largest quantity is being produced.

What the Experiment Station Has Found

The Kansas Experiment Station has recently made a careful study of the cream situation and has found that a large percentage of the cream sold in the state is inferior in quality and will not make first-grade butter, but is made into a second-grade product and sold at a reduced price. The result of hundreds of tests has shown that cream which was kept in well water, running springs, and tanks of cold water, was on an average of a very good grade, but cream that was kept in cellars, caves, and uncooled or unventilated places, was on an average of such poor quality that it would not make more than second-grade butter. Nevertheless, more than two-thirds of the cream produced was kept in the latter class of places.



The Home of First=Grade Cream

This illustration shows an excellent arrangement for properly cooling cream. The tank should be placed on the north or east side of the separator house or other shaded place.

The temperature tests showed that cream kept in wells and in places cooled by running water, or by water changed frequently, was less than 60°

F. during the hottest days of July and August, 1911. The cream kept in cellars, caves, and other places not cooled by water, had an average temperature of 76° F. The dampness of cellars and caves is often mistaken for coolness.

Low Temperatures Essential for First-Grade Cream

The souring of cream is caused by contamination with very small forms of life, such as bacteria, yeasts, and molds. The development and the increase in number of this plant life which grows in cream is greatly retarded by keeping the cream at low temperatures. If cream is kept at less than 60° F., which can be done by keeping the can in cold water, it will keep in a good condition for three or four days. If the temperature rises to more than 75°, the bacteria will multiply rapidly, causing the cream to sour quickly and to develop flavors, some of which are not objectionable but most of which cause the cream to become strong and bitter. Such cream cannot be made into good butter.

The Home of Second-Grade Cream

This illustration shows the source of many of the bad flavors found in cream. The practice of keeping cream in cellars and caves has been largely responsible for poor butter and low prices for butter fat.

Contamination by Impure Air

In addition to the bad flavors caused by molds and bacteria, we have also a great deal of poorly flavored cream caused by the absorption of flavors from impure air. The butter fat in cream will very quickly absorb the odors given off by coal oil, spoiled vegetables, strongly flavored meats, and unclean stables; the butter fat is so sensitive to flavors that it also readily absorbs flavors of feed which cattle eat, such as weeds, spoiled silage, or musty hay.

Advantages of Grading Cream

The best results in the improvement of Kansas cream and butter can be brought about by paying for cream according to its quality. Just as the highest grade of butter on the market brings the highest price, so the highest grade of cream which will make the best butter should net the person producing it a better price than is paid for poorer grades. Cream should therefore be graded if the farmer is to be fairly recompensed for the cream he sells. This has never been successfully done, because it was difficult for everyone who buys cream to grade it properly and accurately according to its market value.

When we consider hand-skimmed cream, hand-separator cream, water-separator cream, cream of different ages and of different flavors, lumpy cream and smooth cream, it would appear difficult to grade it accurately according to what it is worth, but, after working on the problem for several years, the Kansas Experiment Station has shown that the different flavors and qualities of cream correspond quite closely to its sourness, or the amount of acid which develops in cream. As a result of this work a simple, accurate test was devised by which cream can be graded according to its market value and in absolute fairness to all.

Everybody Can Produce First-Grade Cream

The standard for first-grade cream has been drawn at a point where cream is about twice as sour as sweet cream on the point of turning. Cream which comes in this class is said to be first grade, as it will make a very good grade of butter. In several communities the dairy farmers are now having their cream graded and are receiving two cents more for first-grade cream than for second-grade cream. In some communities only two-thirds of the cream is first grade and in others nearly nine-tenths is first grade, depending on the way in which the farmers have been accustomed to care for their cream.

Those who are producing first-grade cream and are receiving the highest prices are interested in keeping their cream first grade, and those receiving the second-grade price, or two cents less, are endeavoring to take better care of it. The creameries buying the first-grade cream are obliged to pay more for it than for the general run of cream bought in other places, but they are just as willing to pay more as the farmers are to receive the extra premium money.

If good cream is worth more than poor cream, the man who produces it has a right to expect a higher price for it; and if his expectations are not fulfilled, he has a right to demand a higher price for it when his cream has been graded and shown to be first grade.

NOTE.—(This is the first of a series of circulars dealing with the production of better cream and showing how Kansas dairymen may earn for themselves better prices for butter fat by assisting in a movement to make Kansas butter of such high quality as always to bring the highest market price.)

Kansas State Agricultural College

EXPERIMENT STATION—Circular No. 22

DEPARTMENT OF AGRONOMY
WILLIAM M JARDINE, Agronomist in Charge

The Condition of Kansas Seed Corn

BY

E. G. SCHAFER

There was a long period of dry weather last summer, and the development of corn was delayed. With the more favorable conditions in the fall, growth was renewed, and much of the corn was not thoroughly mature at the time of the early freezes. Such corn contained a high per cent. of moisture, and the freezing destroyed the vitality. It is because of this condition that the quality of seed corn is low.

Usually Kansas seed corn is good, but this year is an exception. There has been general difficulty in securing enough corn from last year's crop for seed. Much of the corn that has been saved for seed is poor in quality and will not grow. Conditions have never before made it so necessary for the farmers of Kansas to make extensive germination tests, and consequently a new situation is confronting them this spring.

This department has tested thousands of ears of seed corn which have been sent in from farmers from different parts of the State. A few of these samples have been nearly perfect in germination, while others have been so poor that they did not grow at all. The average test has been about seventy-five per cent. good. In some districts of the State the quality is much below that shown by the above tests. Fifty farmers at Rantoul in Franklin county, Kansas, took samples of corn which they had available for seed and put them in a germination tester. A few samples showed a fair percentage of germination; some failed to grow at all, and the average of all the corn tested was only thirty-eight per cent. good. Many of these ears appeared sound, but the germination test showed that the seed-germs were dead. The same condition probably exists in other parts of the State; and if farmers do not make a trial test of their seed corn, it is likely they will be disappointed in their next year's crop. Kansas grows more acres and produces more bushels of corn than of any other crop, and a failure to use good seed will be disastrous. If the corn used for general planting in Kansas cannot be brought up to a higher standard than much of that which has been tested, the condition is indeed serious.

Thousands of farmers are buying their seed corn this spring. They should get a variety or strain that is adapted to growing under their own conditions, and they should be sure that practically every kernel of it will grow. The worth and productiveness of a variety depends more upon its source and upon the conditions that it has previously been subjected to, than upon the kind of variety. To produce best results, corn should be acclimated or developed under conditions similar to those where it is to be grown. With so many chances of securing poor seed it will be necessary for the farmers to use every precaution to get the best seed possible.

While the farmer cannot always choose the best variety, he can be absolutely sure whether or not his corn will grow. If he purchases his seed, he should examine it carefully; he should make a trial test for germination, and if the seed is not satisfactory he should not accept it from the dealer.

The Germination Test

It is not expensive or difficult to make a germination test of corn which will show whether or not the vitality is sufficiently good. A general test may be made by removing and placing in a germination tester five or six kernels from different parts of about one hundred representative ears. If more than five or ten per cent. of these kernels fail to grow, each ear should be tested before planting. If the corn is already shelled, one or two hundred average kernels should be taken for the test. In either case the kernels for the trial test should be placed in a germinator and kept moist and warm. If the corn is not of good vitality, it should be discarded. A great many kinds of germination testers are used in making a trial test. The kernels to be tested may be placed between two moist blotting papers, or between flannel cloths, and in a box where they may be kept warm and moist. At the end of five days the kernels should have sprouted sufficiently to conclude the test.

The Individual Ear Test

It requires more work to make an individual ear test. However, when the general test shows that less than ninety per cent. of the kernels grow, each ear to be planted should be tested separately. A crate or box thirty inches long by twenty inches wide by one to three inches deep, filled with clean sand level to the top, is convenient for making the test. It should be marked off in two-inch squares by fastening cords or wires both ways across the top of the box. These may be fastened to small nails or tacks driven on the edge of the box two inches apart. The ears to be tested may be laid down in a long row where they will remain undisturbed till after the test is complete. Each ear should have a number corresponding to the number of the square in the tester where the kernels from that ear are placed.

The operator should commence at the left of the row with ear No. 1, remove six kernels—two near the butt, two near the middle, and two near the tip. These may be pulled out with the aid of a penknife without injury to the kernels. The six kernels from this ear should be placed in the sand, tip downward, in square No. 1. Six kernels should be taken from ear No. 2 and placed in square No. 2 in a similar manner. Kernels from all other ears which are to be tested may in like manner be placed in the germination tester in their corresponding squares. After the germination tester is full, the sand should be kept sufficiently moist and should be covered with a wet cloth to hold the moisture. The most favorable temperature for germination is from eighty to ninety degrees Fahrenheit. In five days the test should be complete. All kernels which have not germinated in this time are weak in vitality, and the ears from which they came should be discarded. Other forms of boxes than the one described may be constructed for the germination test. It is essential that the test be conducted before the ear is shelled, as it would be impossible to discard kernels of low vitality from shelled corn.

Seed corn which was mature before the early freezes in the fall, and properly cared for, is likely to be of strong vitality.

Preparing the Land for Planting

A large amount of moisture has fallen during the past winter, and there is a goodly supply of it in the soil this spring. If this moisture is properly conserved the chances for a drought next summer will be greatly reduced. Early cultivation of the corn land will conserve moisture and make summer cultivation more easy. In some parts of the eastern section of the State the best way to prepare land for corn is by plowing, even though the corn is to be planted with a lister. The land may be plowed either in the fall or in the spring.

Where there is not sufficient time to plow the land and it is the purpose of the farmer to list his corn, early disking is a common and good practice. As soon as the land is sufficiently dry, cultivation with the disk should commence. The loose mulch left by the disk will conserve moisture, and the cultivation will liberate plant food. This early disking will cover weed seeds and start them to grow. They may then be destroyed by a later disking. It is a good plan to disk the corn land early and continue working the land till planting time.

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Kansas State Agricultural College

EXPERIMENT STATION—Circular No. 23

STATE LIVE STOCK REGISTRY BOARD
C. W. McCAMPBELL, Secretary

The Stallion Law and the Farmer

Are you getting value received for the stallion service fees you pay? If not, why not?

Is it because the breeding of the stallions you have patronized is not what it is claimed to be?

Investigation of conditions existing in 1909, a year before Kansas had a stallion law, revealed the fact that forty-one per cent. of the stallions in the state advertised as "pure-breds," "registered," "full bloods," etc., were simply "grades" and "scrubs." The progressive and thoughtful horsemen of the state, realizing the injury and injustice of the immense amount of misrepresentation being made in regard to the breeding and condition of soundness of stallions standing for public service, appealed to the legislature for protection. The legislature responded by passing the Kansas stallion law, the purpose of which is to require stallion owners to represent and to advertise their stallions for just exactly what they are.

The Kansas Stallion Law Protects the Kansas Farmer

This law was passed particularly for the protection and benefit of the Kansas farmer and mare owner. Are you taking advantage of this means of protection? This law provides a means whereby the farmer and mare owner may know the exact breeding and the condition of soundness of every stallion standing for public service in the state. And how may the farmer secure this information? By reading the license which the state issued for every stallion standing for public service. In case the stallion owner has not posted his state license in a conspicuous place, as required by law, mare owners may secure the desired information by simply sending a post card to the State Live Stock Registry Board at Manhattan. The stallion owner and the horse breeding interests in general, as well as the mare owner, are greatly benefitted by this law.

The Kansas Stallion Law Protects the Stallion Owner

This law is a benefit to owners of worthy stallions in that stallions now stand under their true colors, grade stallions and unsound stallions being required to stand as such. Stallion purchasers have a means of protecting themselves against unscrupulous dealers who have been selling a great many grade stallions as "pure-breds," furnishing with such stallions "fake" or fraudulent pedigrees. To avail himself of this protection, the stallion purchaser should purchase his stallions subject to approval by the Live Stock Registry Board as to purity of breeding and condition of soundness, and not pay for the stallions until such approval is received in the form of a state license. Most Kansas stallion firms are furnishing state licenses with stallions they offer for sale.

The Kansas Stallion Law Protects the Horse Breeding Interests in General

The horse-breeding interests in general are immensely benefitted by the elimination of the graft and misrepresentation that have prevailed in the past. It has put horse-breeding in Kansas on a "square-deal" basis. It is evident that a law of this kind is an absolute necessity for the protection of the horse-breeding interests of the state. It protects the general public against the unsound and undesirable stallions barred from other states, as well as against graft and misrepresentations within the state. Every farmer and mare owner should be familiar with this law.

There Are Too Many Grade Stallions in Kansas

The State Live Stock Registry Board has issued licenses for 7843 stallions to stand for public service in Kansas, fifty-eight and one-half per cent. of these licenses having been issued for grade and scrub stallions and only forty-one and one-half per cent. for pure-bred stallions. A large number of these grade and scrub stallions with "fake" and fraudulent pedigrees were sold as "pure-breds" to unsuspecting purchasers at prices ranging from $500 to $4000. The patrons have bred mares to these stallions thinking the animals were pure-breds. These stallions are now known for what they really are—"grades."

Greater Profits Derived From the Use of Good Pure-Bred Sires

Improvement in the average quality of our Kansas horses rests with the mare owners and the sooner they come to realize and to appreciate the value of, and to demand the services of, good, sound, pure-bred stallions, the more certainly and rapidly will the general average of our horses be improved. It is the intensified inheritance resulting from many generations of breeding the best to the best, using no outcrosses, and always with the same ideal and purpose in mind, that enables the "pure-bred" to stamp his characters upon his offsprings. The "grade" with two, three, or four top-crosses lacks this intensified inheritance of characters and his diversified inheritance precludes his use as a sire. These are facts, not theories. Practical illustrations may be seen on every hand if we will simply allow ourselves to see them. As an illustration, at a recent farm sale, colts rising three, uniform in quality, ready to do considerable work the coming season, sold at an average of $76 a head. Colts rising two, averaged $46. The sires of these colts were ordinary grade stallions whose service fees ranged from $6 to $9. Weanlings from the same mares but from a very excellent pure-bred stallion standing for $15, sold for $101, this being $25 per head more than rising three-year-olds brought, due entirely to the influence of a good, sound, pure-bred sire. The service of a grade or scrub stallion is expensive even if given free of charge. On the other hand, do not breed to a stallion simply because he happens to be registered.

Beware of Hereditary Unsoundness

Beware of stallions that are hereditarily unsound, for it is just as unprofitable to raise unsound horses as it is to raise scrub horses. You may ask what is meant when certain unsoundnesses are designated as hereditary. It means that such unsoundnesses are due primarily to a weakness of the part involved and that this weakness may be in the form of one or all of the following conditions: poor conformation, poor quality of tissue, or an insufficient quantity of tissue. These weaknesses are physical characteristics, and as such, are transmitted to the offspring. As such an offspring develops toward maturity and is required to do the ordinary work that a horse free from these weaknesses should do without disturbances of function or structure of any part, then the evidences of these weaknesses begin to appear in the form of one or more of the various hereditary unsoundnesses. Hence it is not the unsoundness itself that is transmitted, but rather the cause in the form of a weakness. Seek and patronize the stallion in which there is combined soundness, good individuality, and good breeding. Never accept any one of these qualities alone; all three must be combined to insure success. The good, sound, pure-bred stallion is a public benefactor; the scrub stallion is a public nuisance.

There is an Insistent Demand for High-Class Horses

There is an insistent market demand for high-class horses, especially for draft horses, that cannot be supplied. On the other hand, the country is flooded with common ordinary "plug" horses. They do not fill any particular requirement or demand, hence the very low and profit-killing prices for which they must sell. This insistent demand for high-class draft horses does not come from the market alone. There also comes a demand from the farm, for this is a day of heavy machinery demanding an increased amount of motive power. Experience has proven that the most satisfactory and economical form of motive power on the average farm is the heavy, sound draft mare. Besides doing most of the farm work she will raise a valuable colt each year, if properly handled. Thus she is constantly producing a profit other than by means of the work she does. The gelding or mule will not do this and in these days of high-priced lands, feeds, and labor this proposition is worthy of careful consideration.

Which class of horses are you raising, the profit killer or the profit maker?

Some Things to Avoid in Breeding Horses

I. Hereditary unsoundnesses involving highly organized structures
  1. Defects of vision
    a. Cataract
    b. Amaurosis
    c. Periodic Ophthalmia
  2. Roaring (Laryngeal Hemiplegia)
  3. Heaves (Pulmonary Emphysema)
  4. Ridgling (Cryptorchidism)
  5. Stringhalt

II. Hereditary unsoundnesses characterized by bony enlargements
  1. Bone Spavin
  2. Ringbone
  3. Sidebone

III. Hereditary unsoundnesses involving softer structures
  1. Bog Spavin
  2. Thoroughpin
  3. Curb

IV. Unsoundnesses not quite so strongly hereditary as the above list
  1. Rheumatism
  2. Melanotic Tumors
  3. Cribbing
  4. Weaving

V. Poor conformations of all kinds

Some Things to be Considered in the Improvement of the Kansas Horse

1. Breed with a definite ideal in mind.

2. Patronize only the best sound, pure-bred sires.

3. Use only sound mares for breeding purposes.

4. Do not mix types.

5. As far as possible, stick to one breed.

6. Feed liberally the mares you have bred.

7. Be sure to read the state license of the stallion you patronize.

If you are breeding draft horses, seek for a combination of soundness, size, proper conformation, quality, and action.

If you are breeding light horses, seek for a combination of soundness, proper conformation, quality, speed, style, and action.

Boost for your local fair. Enter your stock and have it well broken by show time. Exercise every care and attention, that your stock may show to the best possible advantage.

Join the Kansas Horse Breeders' Association.

Kansas State Agricultural College

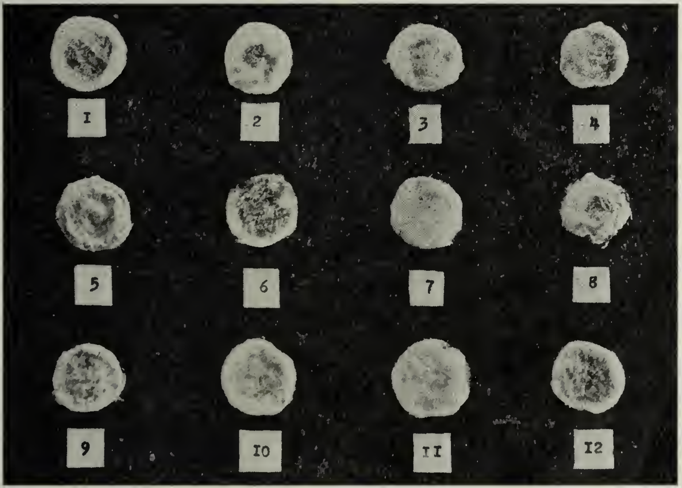
EXPERIMENT STATION—Circular No. 24

OFFICE OF STATE DAIRY COMMISSIONER
D. S. BURCH, Commissioner

Better Butter for Kansas

A Circular Explaining How Dirt and Bacteria Get Into Cream and the Effect They Have on Butter-Fat Prices

Kansas dirt in the proper place is a valuable agricultural asset, but when found in milk it is a sign of unclean dairying and criminal carelessness.



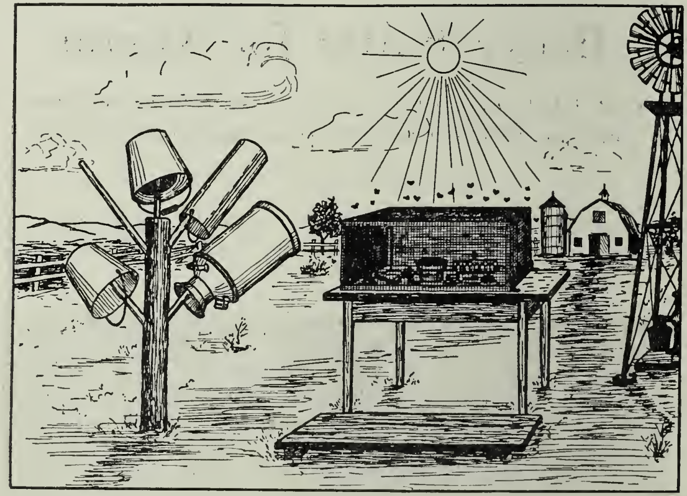
Cotton disks, showing dirt contained in twelve pints of milk of varying degrees of purity. All of the milk had previously been strained through an ordinary strainer.

It is difficult to convince a person who has never cleaned a separator bowl that average milk contains considerable quantities of dirt and manure, but an examination of separator slime should convince the most skeptical that painstaking methods in dairying are necessary if we expect to sell or consume clean and wholesome milk products.

The dairymen of the state pay dearly for the dirt in milk, since the standards of all dairy products on the market and the prices paid for milk and cream are determined by their flavor and purity. Butter of good flavor cannot be made from cream skimmed from dirty milk.

High Standard of Purity for Dairy Products

Most foods which are dangerous to health warn us of danger either by their odor of decay or by their change in appearance. Bad eggs proclaim themselves by an offensive odor and spoiled canned goods are either overgrown with mold or have an unnatural appearance. The souring of milk is regarded by many as the first indication of impurity, but both milk and cream undergo decomposition and may be dangerous to health long before souring occurs. For this reason an exceptionally high standard of cleanliness must be observed in milk production.



Sun-Rack and Table for Airing Milk Utensils

An efficient means of keeping milk utensils and separator parts clean and sweet. The wire cage made of window screen should fit the table fly-tight. Sunlight is a powerful disinfectant. Utensils should not, however, be thus exposed in dusty weather.

The principal sources of contamination are dust from the air, dirt and manure from the cows' bodies, and particles of old milk left in pails and utensils which were not thoroughly cleaned. All of this foreign matter is heavily laden with bacteria which will pass through the finest strainer, even though the coarser particles of dirt are strained out. Clean milk does not require straining.

Dirty Milk is Dangerous Milk

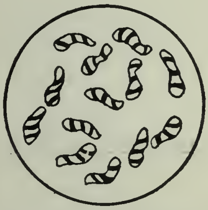
The illustration on the first page shows the amount of dirt in twelve pints of milk taken from twelve different dairies. Each pint was strained through a small disk of absorbent cotton, and the dark color indicates the amount of dirt contained. None of this milk had become sour and no dirt could be seen in it, yet no sane-minded person would knowingly drink the milk which contained the dirt indicated in tests 5, 6, 9, and 12, and he would hesitate to drink any of the others except No. 7.

Although a large amount of the dirt in milk is left in the separator bowl, the great majority of the bacteria formerly on the dirt are washed into the cream, where they finally develop bad flavors and cause decomposition. The most skillful buttermaker cannot repair this injury to cream, and the low quality of butter made from it is responsible for low butter-fat prices.

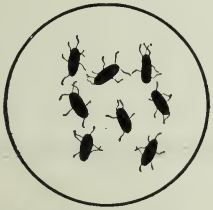
Clean Cream From Start to Finish

1. In favorable weather, keep the cows in the pasture as much as possible, thus preventing an accumulation of manure in the stable or corral.

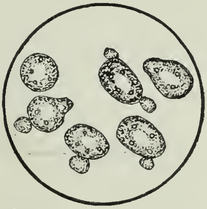
2. Remove the dirt from the cows' udders and flanks before milking, and wipe the udders with a damp cloth.



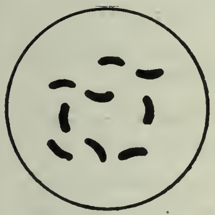
Bacteria which cause diphtheria



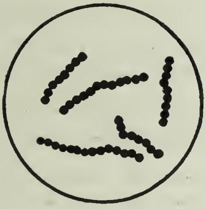
Bacteria causing typhoid fever



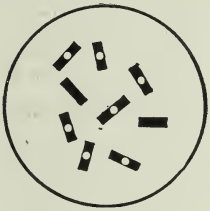
Yeast cells—principal cause of foamy cream



Bacteria which cause tuberculosis in cattle



Milk-souring bacteria



Bacteria causing anthrax in cattle

3. Do not feed hay or dusty feed just before milking.

4. To clean pails and cans, first wash them clean with warm water and a mineral washing powder, then rinse them well, scald them, and allow them to drain.

5. Skim about a 35 per cent. cream.

6. Take the separator apart and wash it thoroughly after each separation.

7. Remove the cream to a milk-house or cool place where the air is pure and where the can may be placed in a trough or barrel of cold water fresh from the well.

8. Do not mix warm cream with cold cream, nor keep cream in cellars or caves.

9. See that all cans and tinware coming in contact with cream are perfectly sweet and clean, especially in the seams and crevices.

10. Deliver the cream in the morning during hot weather. Make at least three deliveries a week in summer and two in the winter.

11. At all times protect the can containing cream against heat, cold and dust by covering the can completely with a clean canvas.

More About Grading Cream

The foregoing suggestions have called attention to methods for keeping milk and cream pure, but where contamination does occur, each dairyman should be held responsible for his own dirt.

The system of grading cream mentioned in a previous circular accomplishes this end by the payment of higher prices for better grades of cream.

The dirtiest milk and cream contain the largest number of objectionable bacteria. The average drop of second-grade cream has been found to contain over one million bacteria of objectionable nature. The percentage of objectionable bacteria in second-grade cream is nearly three times as great as that in first-grade cream.

The State Dairy Commissioner and deputies have the power to condemn cream which is unfit for manufacture into human food, and they are using this power.

For Cleaner Dairying

1. **Develop the habit of looking for dirt.**
2. **By keeping dirt out of cream, you keep out the bacteria and retard souring.**
3. **Bacteria are conveyed from place to place on dirt and dust—they cannot fly.**
4. **The standard of purity for the cream you sell should be as high as that for the cream you use at home.**
5. **The dairyman who sells cream which has passed through a dirty separator commits an insidious and criminal act against the nation.**

NOTE.—(This is the second of a series of circulars dealing with the production of better cream and showing how Kansas dairymen may earn for themselves better prices for butter fat by assisting in a movement to make Kansas butter of such high quality as always to bring the highest market price.)

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Kansas State Agricultural College

EXPERIMENT STATION—Circular No. 25

DEPARTMENT OF AGRONOMY

W. M. JARDINE, Agronomist in Charge

The Sorghum Crop in Kansas

By A. H. LEIDIGH, Assistant Professor in Crops

The sorghums are adapted to withstand heat and shortages of moisture. They are capable of lying dormant during long dry spells and then producing a splendid growth upon receiving rain late in the season. Sorghums readily adapt themselves to the conditions peculiar to Kansas and are among the most reliable and profitable summer crops to grow. They are quite as well adapted to almost every part of the State as corn, and, if grown, will be found to be very close competitors of corn even in the best corn sections, while in the western part of the State they produce larger yields than corn. In feeding value, their grain, hay, and silage compare favorably with other crops.

The general term sorghum includes not only those sweet sorts erroneously called "cane," but also the kafirs, milo, broom corn, and several others. Those having sweet juice are called saccharine sorghums, while those having a juice which is comparatively lacking in sweetness are called non-saccharine sorghums.

SACCHARINE SORGHUMS.

The saccharine sorghums are used for hay, silage, and sirup. Our best varieties are Black Amber, Orange, and Sumac. Black Amber is an early sort, and because of this fact it is especially well adapted to the western part of the State. Orange, a medium late variety, is extensively grown throughout the State. Sumac, a slightly later variety, is becoming very popular in central and southeastern Kansas.

NON-SACCHARINE SORGHUMS.

The non-saccharine varieties are grown for grain, hay, and silage. Kafir and milo, of which there are many types, are the sorts grown most extensively in Kansas. Kafir may be successfully grown in all parts of the State, except in the extreme northwestern counties, where it is not a reliable grain crop. The Blackhull White is the most popular variety.

Milo is an early grain sorghum. It is adapted only to the western one-third of the State. Dwarf yellow is the only milo we recommend. Milo will mature in less time than kafir; it also stands more dry weather and is as good a yielder. In feeding value, kafir and milo grain are about equal, but kafir fodder is the better. Experiments show that kafir or milo grain is about ninety per cent. as good as corn in feeding value.

SOIL REQUIREMENTS AND SEED-BED.

While the sorghums are adapted for growing on almost any kind of soil, they produce best on fairly heavy, well-drained loams rich in humus; but when grown in Kansas on gumbo, hard-pan, sandy, or other poor soils, they are more successful than most other crops.

These crops usually yield well with little care. A thin top-dressing of barnyard manure applied to the field previous to planting would increase the yields materially. Sorghums are excellent to plant on prairie sod or alfalfa sod. On land which has been cropped for a number of years, the sorghums need deep, thorough preparation of the soil. The lower part of the seed-bed should be well settled and the surface soil quite loose. This condition can be best secured by fall plowing. If the land is apt to blow, instead of plowing, fall listing is advisable.

Early soil preparation stores up moisture, prepares plant food, kills weeds, and eliminates insects. No matter how the crop is to be planted or for what purpose it is being grown, early work on the field is absolutely necessary. The land will thus be prepared and ready for seeding while the soil is yet too cold to germinate sorghum seed but not too cold to germinate weed seeds. Cultivation of almost any kind will then kill the weeds and leave the ground in splendid condition.

TIME AND METHOD OF PLANTING.

Sorghum planting should be done late in May or early in June. Where the crop is for hay it is advisable to plant at least part of it later than this, so that it is not all ready to be harvested at the same time. If hay is desired, the seed may be planted with a wheat drill. In the western part of the State one to one and one-half bushels of seed an acre are required, while in the central and eastern parts about one hundred pounds of seed an acre are required for a fine quality of hay. In the drier parts of the State, row planting, in order to cultivate the crop, is greatly to be preferred to the above method. For planting in this way, one-fourth to one-half bushel of seed an acre should be used, according to soil and moisture conditions. With careful cultivation both before and after seeding the moisture will be saved for the crop. Farther eastward in the State seeding should be done at the rate of one-half to one bushel of seed an acre in order to produce fine hay when planted in rows. If light seeding is practiced, the crop will be coarse and difficult to handle. Heavy seeding, especially if on well-prepared soil, will give a crop of much finer and less watery roughage.

Sorghum for grain, seed, silage, sirup, or broom material should be planted in rows like corn, and cultivated; in fact, the crop is handled throughout about like corn. To plant sorghums in rows, either listing or surface planting may be practiced. For listed sorghums the ground must be warm before planting. Extreme deepness in listing should be avoided. For any method of planting, the land should have been worked several times between April 1 and June 1, to kill weeds and prepare the soil to stand without tillage during the early part of June, while the plants are too small for early cultivation.

CULTIVATION.

As soon as the plants start to grow, early cultivation is absolutely necessary. If surface-planted, the harrow should be used at least twice while the plants are too small to permit the use of other tools. The cultivator should be run deeply the first time over. The best cultivation for listed sorghum crops is done where the disk weeder is used.

The first work with the shovel cultivator should be deep and thorough, unless the only moisture in the ground is in only the top three or four inches, in which case cultivation should be shallow. Late cultivation should not be over three inches deep, but can be kept up during the summer without disastrous results, unless the ground is dry below and the plants are living on surface moisture alone.

As soon as the plants are a foot or so high, the deepest cultivation may be given. It is especially important to tear up the middle of the rows thoroughly and fully before the plants are too large. If the crop has been planted with the lister, the ridges must be thoroughly broken up to a depth that will be equal to four inches below where the surface will be after the land is leveled. However, where the crop is listed, do not level the land until the plants have reached a height of more than two or three feet.

USES AND CARE FOR SPECIAL PURPOSES.

GRAIN.—All kafir and milo grain should be threshed and crushed or ground for feeding. As this grain is deficient in proteids, the ration should be well balanced with alfalfa, bran, cotton cake, or tankage. The grain is considerably injured in many threshers, and in order to save the cracked seed it is not always well cleaned by the thresher. When stored, the cracked and dirty grain settles closely together, and heating may easily result. Lack of ripeness is supposed to add to the danger of heating. Thoroughly cleaning the grain will greatly lessen the danger of heating.

HAY.—Sorghum roughage and hay is good feed for maintaining mature animals. For growing stock it needs to be supplemented with the same general kind of feeds as should be used with the grain.

SEED.—Sorghums produce seed best when not planted too thickly and when a comparatively plentiful supply of moisture is available at and for a few weeks after heading time. A point to be most closely observed in seed production is the necessity for a comparatively thin but regular stand of plants in every row.

SIRUP.—For sirup production, a variety of sorghum should be used which is pure and which is adapted to the locality. Its length of growing season should be such as to allow it to ripen fully before frost. Thin planting is necessary. For sirup making, Kansas Orange is the variety most widely used in the State. Amber is frequently used on account of its earliness. Sumac, or Red Top, is to be recommended as a reliable variety for sirup production in most parts of the State.

CATCH CROPS.—All early-maturing sorghums are suitable for late planting. Early Amber and Dwarf milo are considered to be the best kinds for such use. As a catch crop of milo is usually cut before fully mature, its forage is very satisfactory in quality. Chinch bugs are very destructive to young sorghum plants; this fact may effect the practicability of using the crop in some cases.

SILAGE.—For silage or for coarse roughage, the crop is planted about as if grain or seed production were desired, the largest total acre-yield being the real aim.

For silage the sorghums ought not to be harvested until they are nearly ripe. At an earlier stage there is less dry matter an acre and also a very large proportion of water, which is not desirable. If the crop is fully ripe, the fiber is not as digestible as the unripe fiber. As a general rule, this class of crops gives a very large silage yield an acre. Owing to their high carbohydrate content, fermenting and heating in the silo will be very pronounced. Such silage is spoken of as "very acid," but this is not undesirable. Where the silo has been filled with corn, the sorghums may be used for the second filling after settling has taken place, because they will still be in condition for such use after the corn is too ripe.

PASTURE.—If pastured, sorghum plants that are checked, stunted, or killed during growth may be poisonous to live stock. Heat, drouth, or frost all seem to produce a similar effect. The hay is not known to be injurious; cutting and curing seem to make the poison harmless. It is not known whether putting poisonous sorghums in the silo will give a safe silage or not.

HARVESTING.

Growers like to harvest sorghum crops as late as possible in the fall so as to prevent injury by rain and heat. Late harvesting may also lessen the labor bill. For forage, the crop is harvested at the soft-dough stage, and for seed it is harvested at the hard-dough stage. The drilled hay-crops may be cut with a mower or with a grain binder. The row crops may be cut with a corn binder or they may be headed. There is a wagon-box attachment made which is a success when used for heading kafir. The ordinary small-grain header has been successfully used for topping kafir and milo. To do this, it is usually necessary to raise the platform and sickle-bar an additional four to eight inches by means of a plank.

Broom corn should be cut or jerked before it has become too woody. The best time is during the blooming period. The brush may be partly cured in the field, but this practice is decidedly a bad one.

SELECTION AND CARE OF SEED.

Sorghums easily cross-fertilize, and mixed seed is the result. Because of the irregular growth of the mixtures, pure seed is very desirable. Pure seed is sold at a good price and brings a good profit. Selected heads should be gathered before the regular harvest. Dry them and do not thresh them until planting time approaches. To improve the crop further, it is only necessary to plant separate heads in separate rows and thus be able more easily to recognize the best-producing blood.

With kafir and milo, selection for earliness and grain-producing ability is needed. Broom corn should be selected for the desired height and for the quality of the brush. The sweet sorghums should be selected for forage strains that will be more leafy and stand up well. Some growers are endeavoring to increase the seed production of the forage sorghums, but unless the forage quality is also kept up, this effort is useless. Good, viable sorghum seed can only be secured from mature plants. Plants grown for the production of hay, sirup, or brush must be harvested before the seed is ripe. Therefore, it is necessary to produce the seed of these kinds on special seed plats grown for seed production only and allowed to fully mature.

All kafir and milo for seed should be fanned and sacked as soon as it is threshed. In cleaning sorghums for seed, the fanning mill should be equipped with a sheet-metal sieve having a long, narrow slot instead of a round hole. The slot should be wide enough to let cracked grains through, but not whole grains. A square or round hole large enough for half-grains will pass whole grains also. Before planting, always test the seed for germination.

DISEASES.

There are two kinds of smut which injure sorghums: grain smut, which attacks each separate grain; and head smut, which attacks the whole head. If head smut is present in a field, it is of great importance that no seed be saved. Buy new seed.

Grain smut may be prevented by dipping the seed in a poisonous solution. Mix one pound of full-strength formalin with thirty gallons of water. Have the seed in burlap sacks, tie the sacks well, but have them only half or two-thirds full. Hang these bags in the formalin solution one hour and stir or move them about somewhat, then spread the seed out and dry it thoroughly. After it is completely dry, test it for germination, as the treatment may kill the seed if not carefully done.

CONCLUSION.

There are a few points in favor of these crops that should be emphasized. They are practically sure of making either hay, silage, or seed in Kansas every year, if handled in a similar way and under conditions that are favorable to corn. They stand more dry weather than does corn, and are especially adapted to central and western Kansas conditions, and should be grown on a larger scale. It is a fact that these crops are more largely grown in certain parts of the eastern half of the State than in the western half. Probably the chief reason for this peculiar condition lies in the fact that it is practically impossible to plant wheat in the sorghum fields with any success, and therefore the wheat farmers do not grow sorghums.

Sorghums usually grow late in the fall. They remove water and plant food from the soil in large quantities much later than most of the well-known crops. The fields are necessarily left much drier than where early-maturing crops are grown. Until this lack of moisture is corrected, the soil is in a dry and unproductive conditions. Warmth, air, and moisture are all needed to get the land into good tilth again. The land needs to be thoroughly plowed, and late-planted crops should be used there the next year.

After sorghums, small grains and other crops which need moisture during the fall and early spring suffer most. In all of western Kansas the sorghum fields should be put into fallow in the winter or spring and wheat sown on this fallow in the fall. This makes it possible to put wheat in on excellently prepared land. After wheat, plant some sorghum crop, such as kafir, milo, or saccharine sorghums for seed or for roughage, then fallow the land again and plant it to wheat.

Such a cropping plan allows the production of our two best dry-farming crops, with an opportunity after each harvest to store moisture at a very small expense before time to plant the next crop.

Kansas State Agricultural College

EXPERIMENT STATION—Circular No. 26

DEPARTMENT OF VETERINARY MEDICINE
F. S. SCHOENLEBER, Veterinarian in Charge

NAVEL ILL

Dr. F. S. Schoenleber

Navel ill is an infectious disease, and each infectious disease is caused by a specific definite organism. The laws of reproduction, growth and development of all living things are fixed by Nature. These laws are practically the same in both plants and animals. A pumpkin seed never develops into a watermelon. A kernel of corn will produce corn only. A drove of hogs turned into a pasture and supplied with plenty of shelter and good feed and drink will never develop into a herd of cattle. The germ of distemper cannot develop into the germ of glanders or into lockjaw, nor can the bacillus of tuberculosis cause typhoid. Each living thing produces its own kind only.

A grain of wheat dropped into a suitable soil where there is sufficient plant food, moisture, and warmth will in a certain number of days begin to swell, to grow, and will finally mature. The result is the production of an increased number of grains similar to the one originally planted. This is performing its full mission for which it was intended by Nature. Some of these new grains may be larger or stronger, others may be smaller and weaker than the parent grain, depending much upon the ancestors and the health and strength of the grain planted; the amount and the kind of food available and the conditions of moisture and temperature during its period of growth and development. The trained farmer or stock raiser has only to look at the growing plants or animals to tell from what kind of seed they originated.

It is easy to realize these conditions and laws when they are applied to animals and plants which can be seen with the naked eye, but it is much harder to realize when applied to bacterial life. In these cases we do not see the cause, but see only the effect, but each germ has a particular way in which it shows its presence. The organism of diphtheria, for example, shows its presence by certain symptoms and lesions in its development, and it always happens that when certain conditions are found a microscopic examination always reveals the cause—the specific organism. Each particular germ carries with its development a certain set of symptoms, and whenever those symptoms present themselves under certain conditions the conclusion is obvious—they are always caused by a certain germ. This is how we recognize the causes of certain diseased conditions of animals or plants.

Practically all infectious diseases are caused by organisms of some kind, and all diseases caused by such organisms are preventable. In order that an infectious disease may spread to other animals, it is necessary for the organism which causes the disease to gain entrance into the body of the other animal before that animal will contract that particular disease. The organism and the animal must be brought together—keep them apart and the organism will eventually die—keep them apart and an infectious disease cannot spread. This is why State and Federal laws are enacted establishing quarantine to protect the healthy animals and to control infectious diseases.

Cause of the Disease.—In the disease we commonly call navel ill, the organisms usually enter the animal through the navel. It is a noticeable fact that where mares are kept in the open pasture or in new enclosures the disease is rarely found—the germ and the colt do not get together. On the other hand, the trouble is most prevalent in old breeding establishments where the germs live from year to year in the breeding pens and stalls; especially do they thrive in damp places. These facts should of themselves suggest the rational methods of handling this particular trouble.

Some of the Symptoms.—The foal is noticed to be dull and probably lifeless or indifferent to nourishment and probably appears to have some fever. The temperature will be found to be above normal, while the hair is rough and harsh looking. Chills are sometimes noticed.

Many cases show a lameness in one or more limbs, which may shift from one limb to another, reminding one of a case of rheumatism. One of the most common symptoms can be best described by the expression the veterinarian usually hears in these cases, "The mare must have stepped on it." Most often the hock of one leg is affected, but any other joint may be involved. As the disease progresses swelling and heat can be noticed in the affected joint, and this swelling gives it a "boggy," soft feel.

Usually these swollen joints burst and discharge a yellowish, thick, greasy fluid, which dries and crusts on the hair, while the wound refuses to heal. The young animal continues to get weaker and finally is unable to get on his feet. He may last several months in this condition or he may die quickly.

Many cases show only slight swelling about the navel, with some yellowish pus accumulation. Other cases resemble strangles or distemper. The bowels may show constipation and very light yellow pasty discharges in some cases; in others diarrhea is noticed at the beginning.

Post Mortem Appearances.—Careful examination of the carcass after death reveals the navel swollen and jelly-like in consistency, while the blood vessels leading from it are corded and inflamed, often containing clotted and partially decomposed blood and sometimes pus. Intestines contain clumps of hard, pasty fæces and the peritoneum, or inner lining of the abdomen, is often somewhat inflamed. There may be abscesses in different parts of the body, particularly in joints.

Sometimes the urachus is open and urine discharges from the navel in a small stream or by drops, which keeps the under part of the belly moist. This, in itself, is not likely to cause the death of the foal, as it often subsides if left alone. It may be closed by blisters or it may be necessary to close it with sutures. This condition should not be neglected, as navel infection might occur. Keep an antiseptic on the parts, and if it does not close in a few days, get a veterinarian to see what is necessary to do to close it.

Treatment.—For the average stock owner, prevention is worth far more than attempts to cure because of the ease of preventing its occurrence. Since it is known to be due to infection and that the infection probably enters the navel, efforts to prevent the trouble should be directed here. **Keep the germs and the colt apart.**

Means of Control and Treatment.—Premises once infected should be considered dangerous until thoroughly disinfected, which may be done as follows: A few days before the mare is ready to foal, remove her from the usual stall to a foaling place from which all litter has been removed and burned, and the ground and walls thoroughly sprayed with a 5 per cent solution of coal-tar dip in water, or a one to five hundred solution of bichloride of mercury and water, thickly applied with a spray pump. Let this dry a few hours and cover the floor well with a layer of clean, bright straw. Wash the mare's tail and surrounding parts with the same antiseptic solution as used on the floor and walls, diluted about one-half the above strength. Leave the mare alone with good, moderately laxative food and clean water in abundance and wait with patience, not too much inquisitiveness. As soon after foaling as possible, take a cord which has been soaked in tincture of iodine and tie around the navel cord, about an inch from the body, and paint thoroughly over this cord with tincture of iodine. If the cord is visibly soiled, it would be best to wash it off with a good antiseptic before applying the iodine and to apply the iodine several times at intervals of twelve hours.

Treatment after infection has progressed till joints are swollen is rarely satisfactory. Some cases respond well to careful iodine application to the navel and affected joints, with potassium iodide and liver stimulants internally, but the best satisfaction is now obtained by using the Bacterin treatment, vaccinating the colt against this trouble with the product of these germs themselves produced in the laboratory. This treatment, however, is somewhat complicated, and is as yet only satisfactory in the hands of experienced veterinarians. Prevention is so easy and so certain that the stock raiser should devote his energy toward preventing the trouble—keep the germs and the colt apart.

Kansas State Agricultural College.

EXPERIMENT STATION—Circular No. 27.

DEPARTMENT OF POULTRY HUSBANDRY.

W. A. LIPPINCOTT, Poultryman in Charge.

CAPONS FOR KANSAS.

By W. A. LIPPINCOTT.

Kansas has many steers, barrows, wethers, and geldings. She has very few capons. From the standpoint of meat production it is just as important to make a capon out of the cockerel as it is to make a steer out of the bull-calf, or a barrow from a young boar. It is pure waste to allow the young rooster to become staggy, just as truly as it is to allow the young boar, not needed for breeding purposes, to grow into a stag.

Caponizing has the same effect upon the disposition of the male chicken that castration has upon the stallion. It renders him more tractable, less nervous and excitable, and so easier to handle from every standpoint. The true capon will not crow or fight, takes kindly to confinement, and will even brood chicks.

The performing of this simple operation also affects the amount and quality of the meat. As a result of its quieter disposition the capon is an easier keeper than the rooster. He makes greater gains than his active brother and makes them more economically. At the same time, his flesh remains as soft and palatable as when he was a two-pound "spring."

There are a great many places in Kansas where there are no quotations made on capons. In some cases there is good reason for this. It may be that the local buyer has a big outlet for broilers and would rather buy two-pound broilers in the summer than eight- to ten-pound capons in December. It may also be that there are not capons enough offered to make it worth while for him to handle them separately. The result is that the few that are offered are shipped right along with other classes of stock. The local buyer should be interviewed. If he does not want capons, it would be foolish to produce them. If he does want them, is willing to pay for them, and can not get them, it would be foolish not to produce them.

A ten-pound capon can be grown on about the same amount of feed that an eight-pound rooster requires. An eight-pound rooster will bring sixty-four cents if the market is that high. Where capons are in demand, a ten-pound capon will bring twice as much per pound, or $1.60. His food cost is about the same as that of the sixty-four cent rooster.

There are probably very few dealers in Kansas who would not be glad to handle capons at a considerably higher price than they pay for old roosters, if they could buy them in any numbers. Ask your own dealer and find where he stands.

Caponizing is a simple operation. Any careful person can soon learn to do it successfully. The fact that a bird's testicles are hidden away inside the body has caused most people to suppose that the operation of removing them is at once difficult and dangerous. While the percentage of loss is somewhat larger than results from the castration of the larger animals, it need not run much, if any, above five per cent for the beginner. One of the reasons why the number is as large as it is may be that the bird must be older, comparatively, than other farm animals before the operation can be undertaken. The birds that are killed die a quick and painless death by bleeding. They are not a total loss, as they are perfectly wholesome for food.

It is difficult to state the exact size or age at which a cockerel may be most successfully operated upon, as different birds develop differently. As a starting point, however, the beginner will be safe in using birds weighing between one and a half and two pounds if they are of the Plymouth Rock, Rhode Island Red, Wyandotte, or Orpington breeds. Leghorns weighing a pound may be used also. Later, as one becomes more familiar with the matter, the birds will be selected by their "look" rather than by weight or age. The cockerel shown in figure 1 is just ready. The proper time is just before he begins to make comb, when the organs are about the size of a small navy bean.

The tools needed are four in number and may be purchased from any poultry supply house or veterinary instrument company, at from $2 to $5 per set. A sharp knife is necessary for making the incision. Your pocket knife will do if it is sharp. A spreader is needed to keep the incision open while working. A probe that is blunt at one end and has a sharp bent point at the other is used in pushing the intestines aside to expose the organs and in tearing the thin membranes that surround the body cavity. And finally, there must be an instrument for removing the testicles. There are several different instruments made for this purpose and it is largely a matter of preference which is used. The one used in these illustrations is called the spoon forceps.

Where one is making a business of operating it is a good thing to have a special table that can be tipped toward the light, as in figures 3, 4 and 5. For home use a barrel will do nearly as well, as shown in figure 2. In either case what is wanted is something that will hold the bird firmly and well stretched out, at a convenient height. The bird is usually pinioned by looping weighted cords over the legs and wings, as shown in the illustrations. Previous to the operation the only preparation necessary is to starve the bird for thirty-six hours. This will allow the intestines to empty and subside, making the operation much easier and less dangerous. This must not be overlooked.

The operation may be performed from either side. A few feathers should be plucked just in front of the thigh, thus laying bare a small space just over the last rib. The surrounding feathers should be moistened to make them lie down and not interfere during the operation. The last two ribs should now be located by the fore finger of the left hand, as shown in figure 4. Having located the ribs, pull the skin as far toward the thigh or hip as possible. (This is done so that when the operation is over the incision in the skin will not be over the incision between the ribs. The skin slips back, covering the incision in the flesh, as shown in figure 9.) Then pinch the skin with the thumb and fore finger to drive out as much blood as possible. Now make the incision, being careful to follow the space between the ribs. If the bird has been properly starved, there will be no danger of cutting the intestines. The first incision need not be over a half inch long. Then take the spreaders and insert as is being done in figure 5. Be sure to see that each hook of the spreader is against a rib. Spread the incision as far as possible without tearing the flesh. Then follow up between the ribs with the knife, lengthening the incision until the spreaders may be opened to their limit, as shown in figure 6. Then with the hooked end of the probe tear away the thin papery membranes that cover the intestines, as shown in figure 6.

When this has been done and the intestines pushed aside, the testicle will be in plain sight. In a bird of the proper age it will be a rich creamy yellow and about the size and shape of a small bean. In very young chicks whose sex can just be told it is scarcely larger than a grain of wheat. The testicle may be seen in position in figure 7. It is almost between the jaws of the spreader and is glistening in the sunlight.

Just above it the kidneys are located, but can not be seen in the picture. Passing over the kidneys is a large blood vessel, which constitutes practically the only source of danger during the operation. If this vessel is ruptured, the bird will bleed to death almost before it can be taken from the table.

In figure 8 the spoon forceps are grasping the testicle, which is still in place. The care with which the operator grasps the organ without also grasping the blood vessel, or the tissues surrounding it, constitutes the whole trick of the operation. Having grasped the testicle, twist the forceps around a couple of times and pull them out quickly. Remove the spreaders and allow the skin to cover the opening between the ribs. In ten days there will be nothing left but a shiny scar.

It is customary to remove both testicles from one side. In that case it is better to remove the lower one first. Sometimes there is a little bleeding which would hide the lower one if the upper one was removed first. Beginners, however, will do well to make two incisions, one on each side, operating at first on a dead bird. After doing this successfully several times, one may tear away the membranes enough to see the second testicle and remove both testicles through the same incision. In fact, one may become so proficient that he can grasp both organs at once and remove them together.

After the operation the birds should be placed in a yard by themselves and fed on soft food for three or four days. After that time give them their regular rations. At the end of a week they may be turned in with the other chickens. A few of them will bloat during the first week. This is not serious, and is remedied by pricking the skin with a coarse needle or with the little blade of a pocket knife.

If you have taken the organs out clean, the birds will become comparatively quiet and docile. Their combs will stop growing and they will not crow. The hackle, saddle feathers and tail feathers will grow very long and silky.

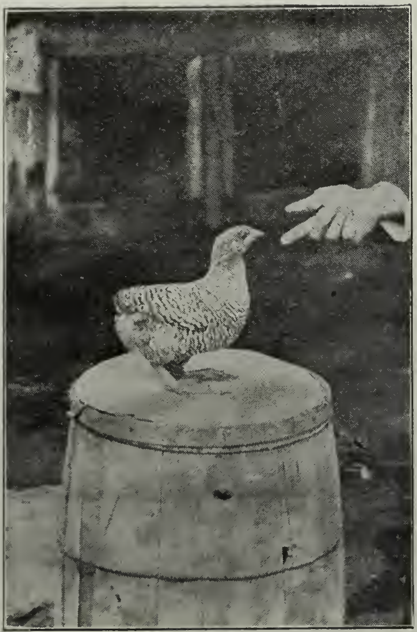

FIG. 1.—Just right for caponizing.
(*Photo. courtesy of Geo. Benoy.*)

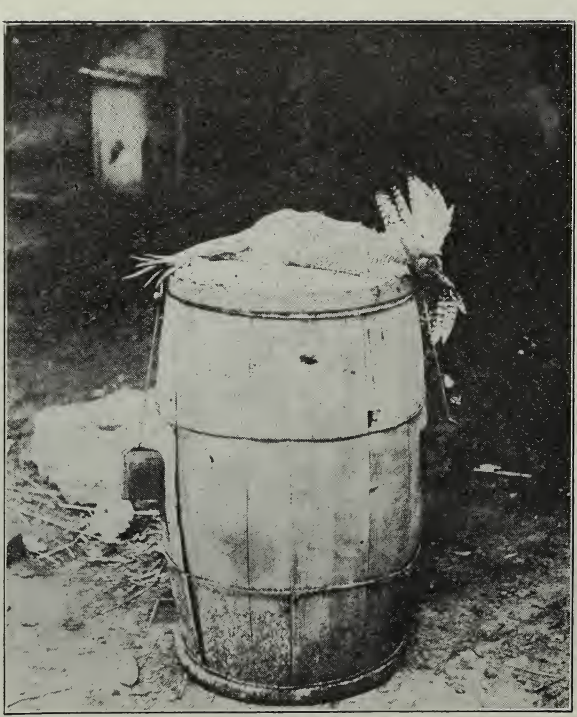

FIG. 2.—A good caponizing table.
(*Photo. courtesy of Geo. Benoy.*)

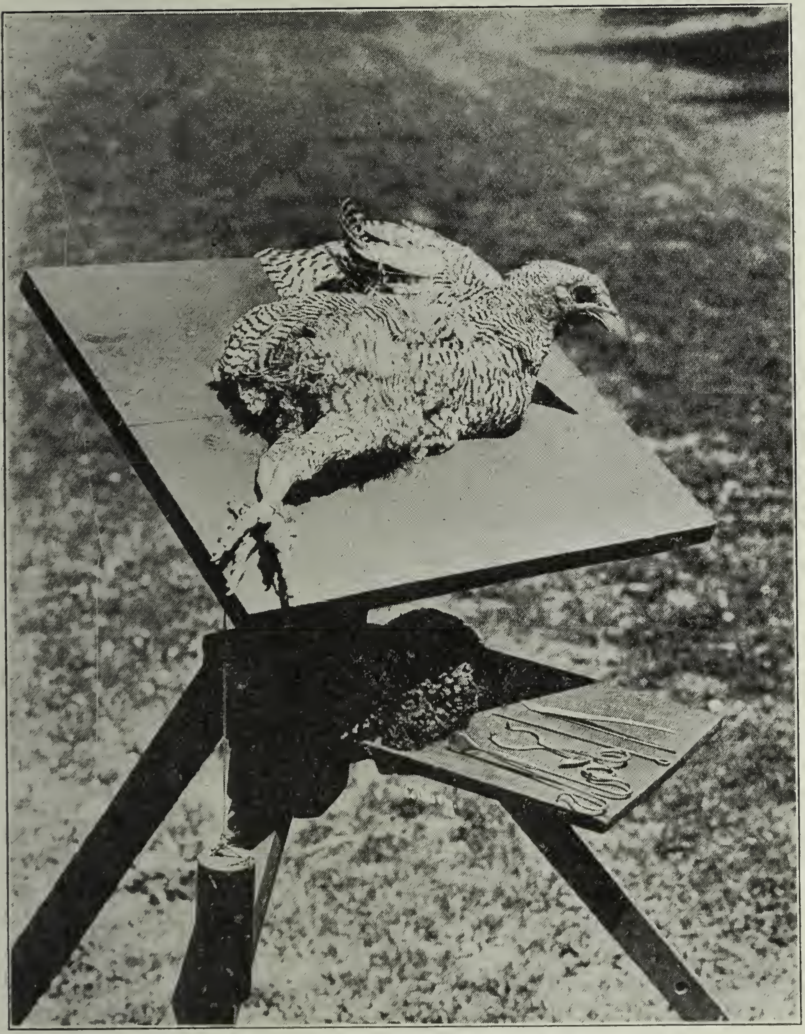

Fig. 3.—Cockerel in place for caponizing.

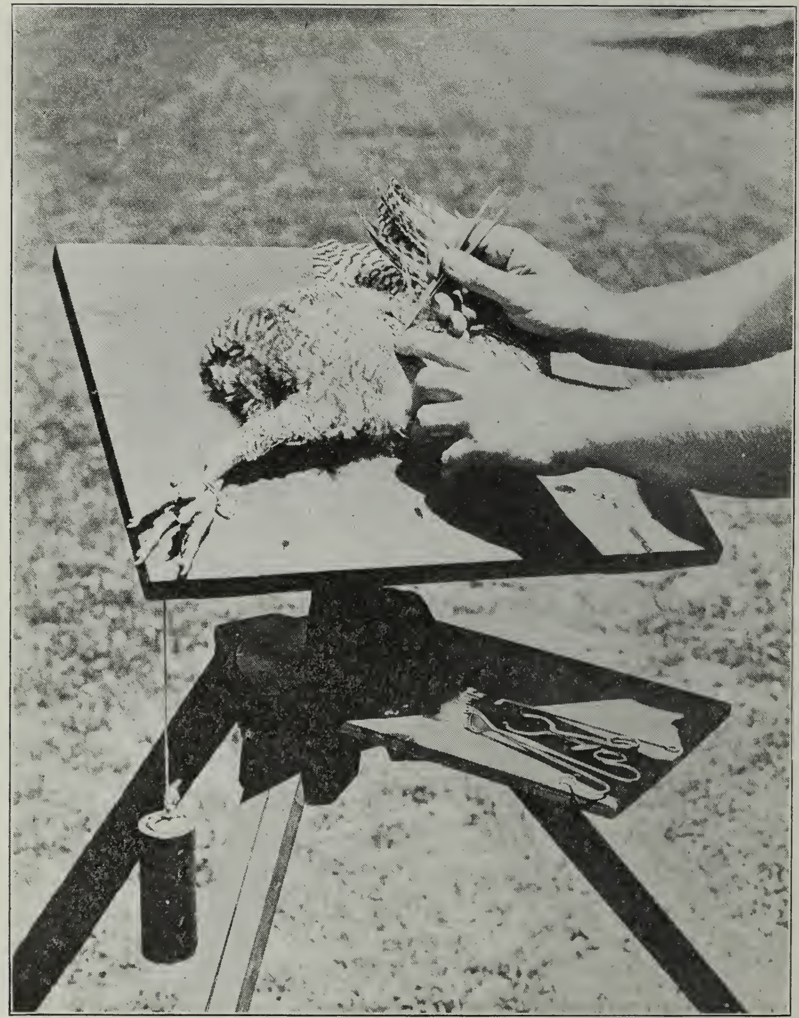

FIG. 4.—Locating the last two ribs and making the incision.

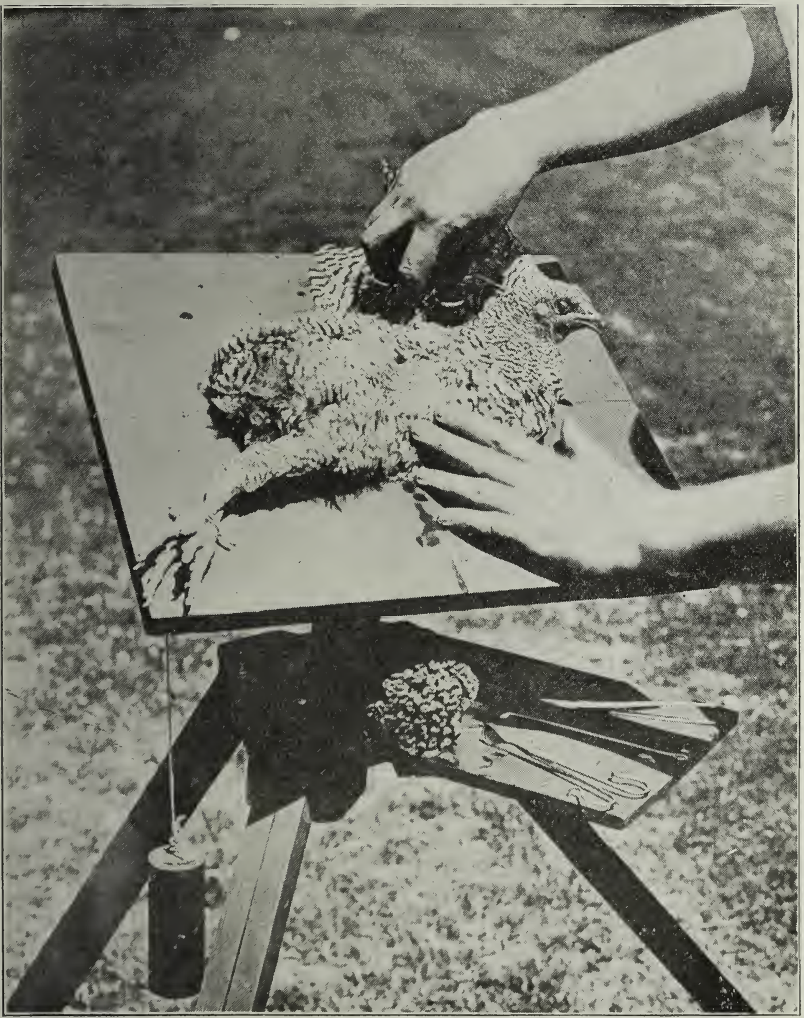

FIG. 5.—Inserting the spreaders.

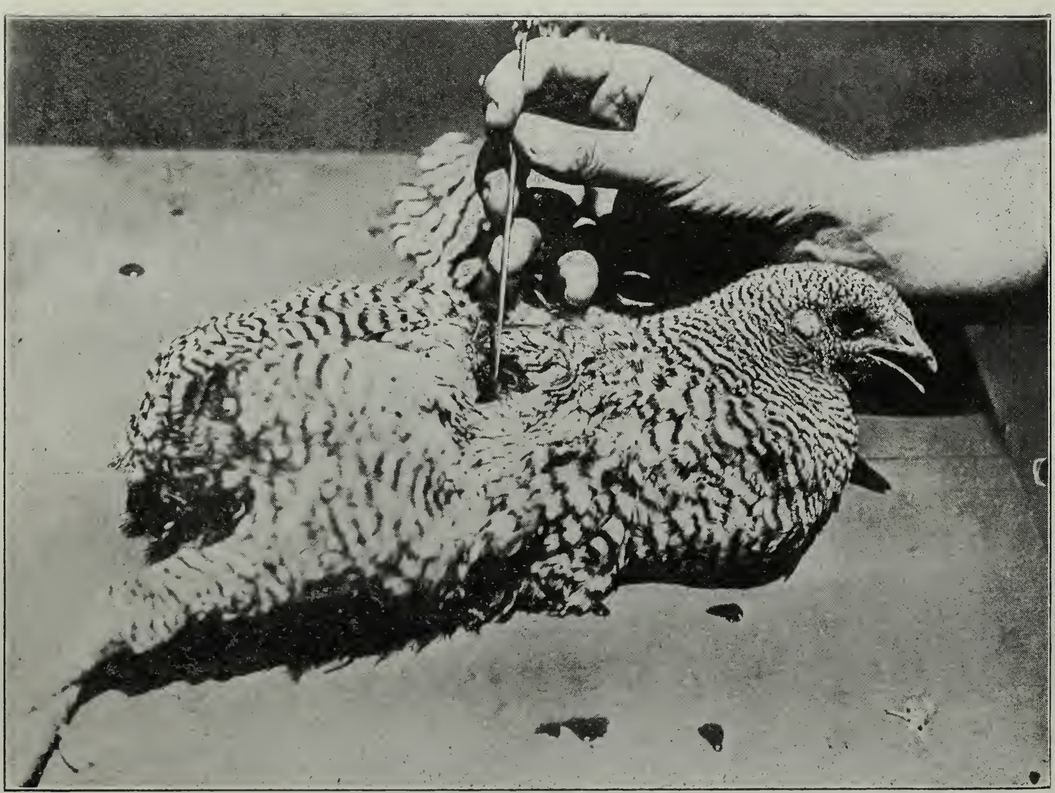

FIG. 6.—Tearing away the membranes.

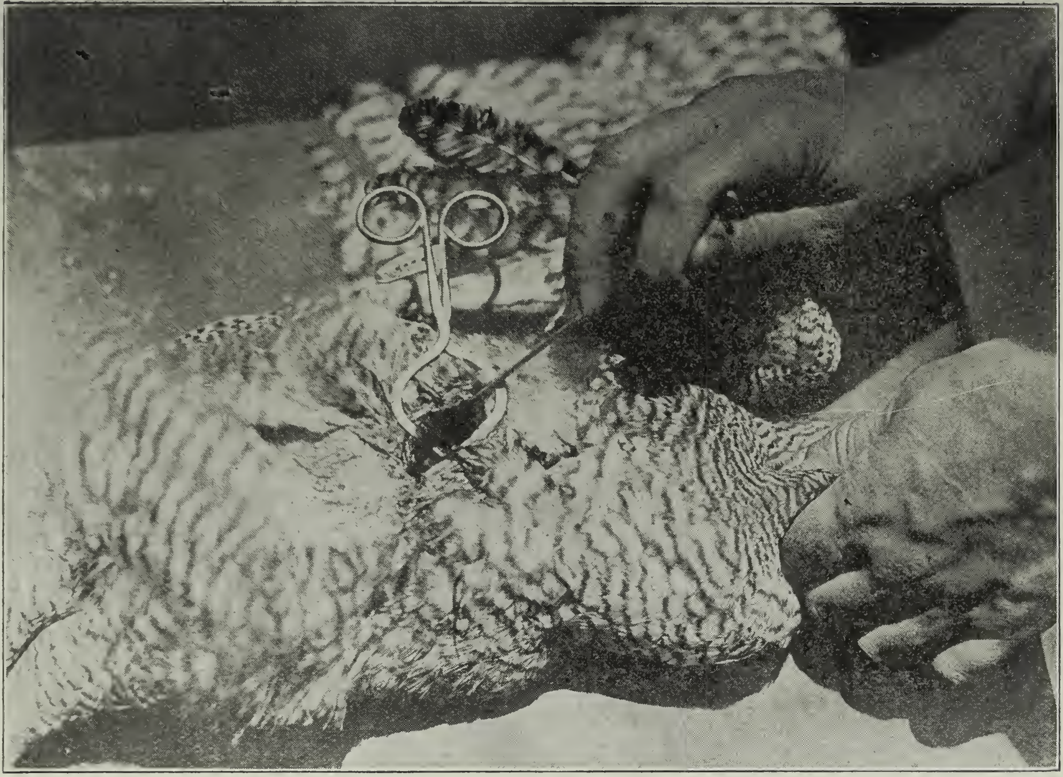

Fig. 7.—Testicle shown in place between jaws of spreader.

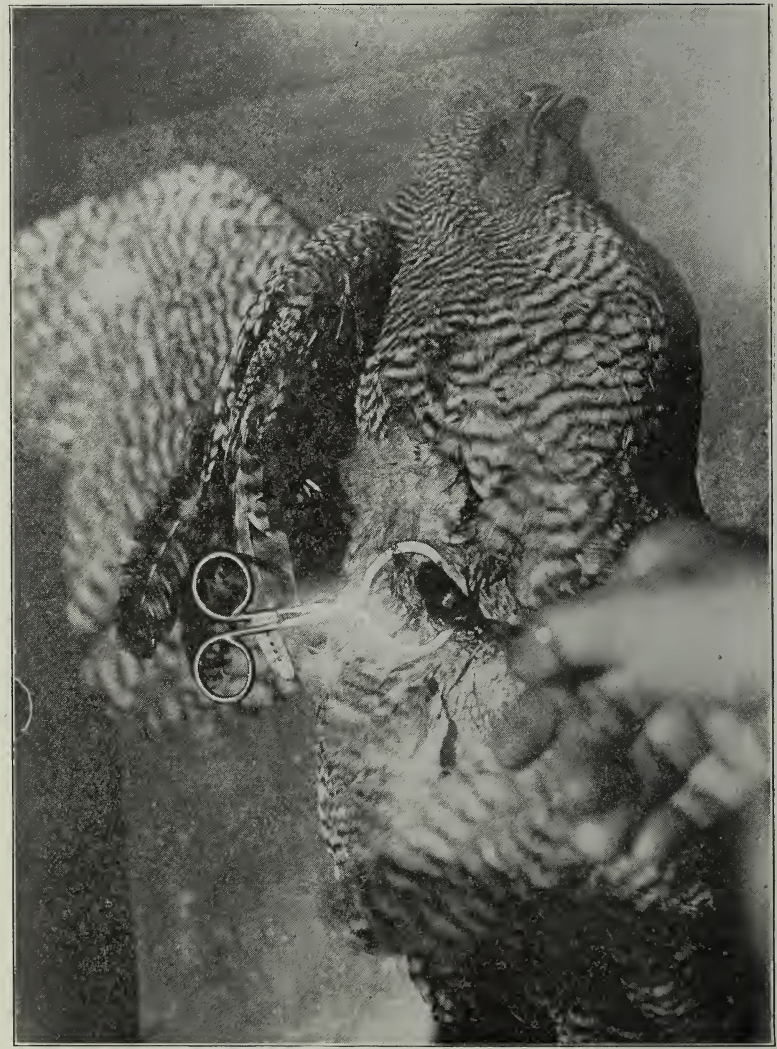

FIG. 8.—Removing the testicle,

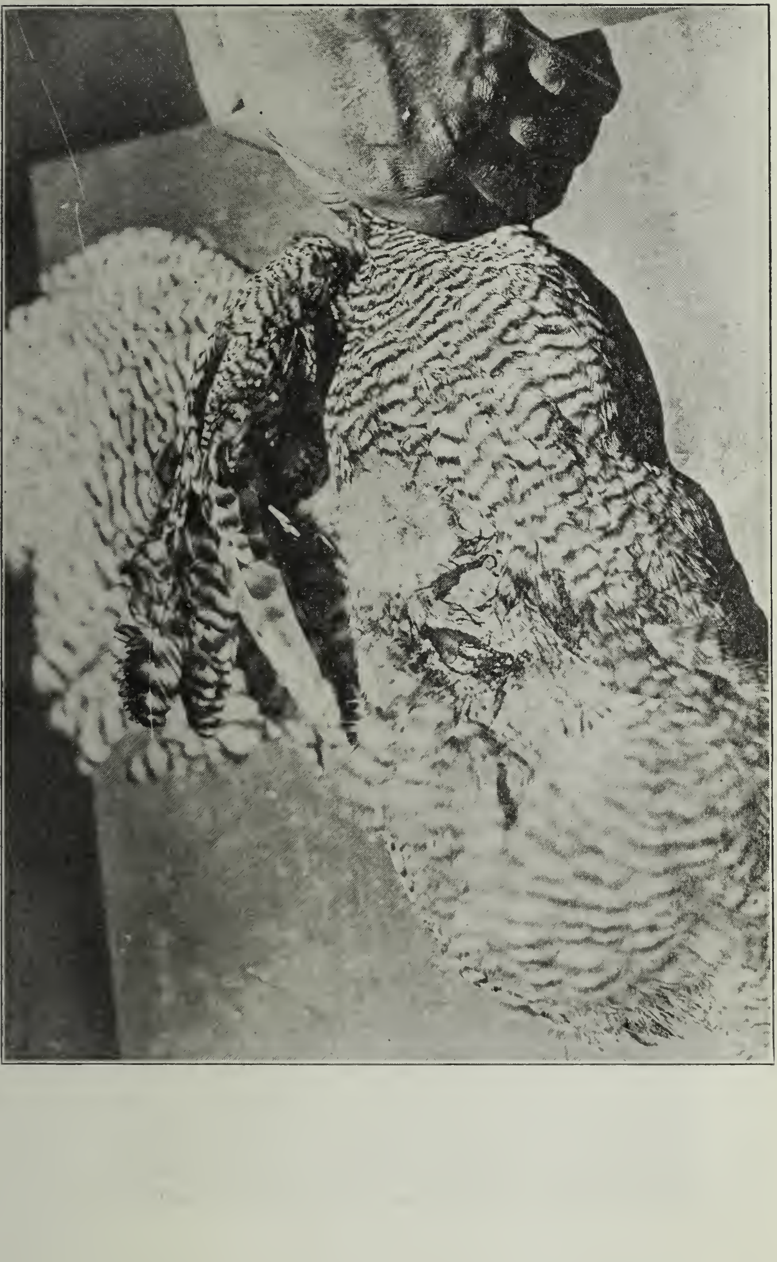

FIG. 9.—After the operation.

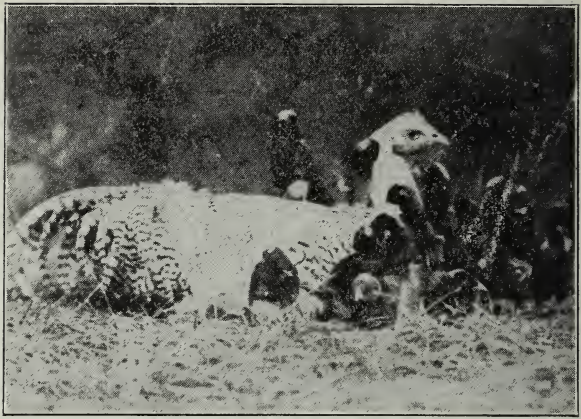

Fig. 10.—Capon brooding chicks.
(*Photo. courtesy Geo. Benoy.*)

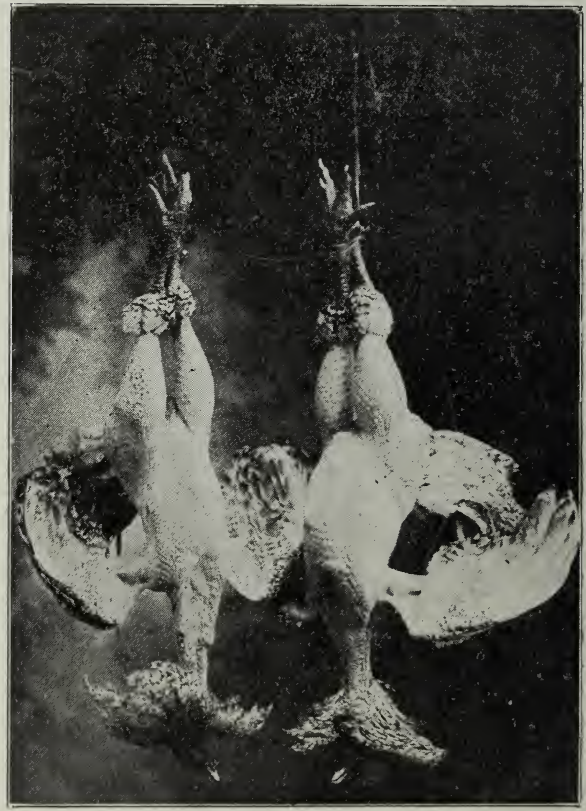

Fig. 11.—Capons dressed for market.
(*Photo. courtesy Geo. Benoy.*)

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 28.

Department of Dairy Husbandry.

O. E. REED, *Dairy Husbandman in Charge.*

Sorghum Crops for Silage

Feeding Experiments with Dairy Cattle

BY

O. E. REED and J. B. FITCH.

Kansas Agricultural Experiment Station.

Sorghum crops, both saccharine and non-saccharine (sweet and non-sweet), can be used for silage with good results. The corn plant has considerable prestige as a silage crop, and it has been more generally used for silage than any other crop. In fact, its use has become so general that some of the farmers and stockmen have believed that it was the only crop fit to be used for this purpose.

Two years ago the Dairy Department of the Kansas Agricultural College planned an experiment to determine the value of sorghums for silage. In most parts of Kansas the yield of the sorghums, such as kafir and sweet sorghum, is considerably larger than that of corn, and in some seasons the acre yield is several times larger. It was thought that if these crops could be made into silage, they would be of particular advantage to the farmers and stockmen of western Kansas, where corn is grown with difficulty and much uncertainty.

The first sorghum crop put into the silo was sweet sorghum, commonly called cane. Previous experiments with this crop and the experience of some farmers have given the general impression that cane contains too much sugar, and that silage made from it would be very sour and would not be eaten by stock. Our results the first year showed that silage made from cane did not contain so much acid at any time during the year as did silage made from corn. This, of course, is quite contrary to the belief heretofore held by many, but is easily explained after thought and investigation. In the past, where cane had been made into silage, it had been put up entirely too early. Those who tried it put it into the silo at the same time that they cut their corn for silage. At this stage of maturity, cane contains entirely too much moisture, or sap, and, when put up at this time, is certain to result in sour silage. With us, the cane was not put up until three weeks after the corn silage was made, at which time the cane seed was hard and the stalk was well filled with sap, but did not contain an excess of moisture. The cane used in this experiment was grown on upland soil on the College farm. One-third of the field was drilled and another third was listed. The remainder of the field was in corn. The drilled cane made 12.5 tons of silage to the acre, the listed cane 8 tons, and the corn made 5 tons.

In the fall of 1912, one silo was filled with cane, one with kafir, and one with corn. The following yields were obtained: corn, 7.1 tons of silage to the acre; cane, 8.2 tons; kafir, 6 tons. The yield of kafir was not a representative one. The season of 1912 was not a good season for kafir, and the early frost cut down the yield considerably. Here, again, we had the same results with the cane as we had previously. It made a good quality of silage, and after analyzing the different silages for acidity, it was found that the cane silage did not contain, at any time during the winter, so much acid as did the corn silage.

FIRST TRIAL, 1911-1912.

In the first year's experiment, cane silage was compared with corn silage as a feed for dairy cows giving milk. Two lots of four cows each were selected from the herd for the experiment. These lots were handled in the following manner:

The cows in lot I were fed for the first twenty days on corn silage. For the second twenty days (after a period of ten days had intervened) they were fed on cane silage. After another intervening period of ten days, the third twenty-day period began, when the cows were again fed on corn silage. The animals in lot II were fed cane silage during the first period, corn silage during the second period, and cane silage during the third period. It was planned to get a direct comparison of these two feeds by comparing in each case the average of the first and third periods with the second period. Cows gradually decline in milk flow, and the average production of the first and third periods would naturally be about equal to the production of the second period. These cows were fed a grain and a hay ration in addition to the silage. The hay ration was kept constant, and the amount fed was based on what the cows would consume. The grain ration was fed in proportion to the amount of milk produced; this remained practically constant during the experiment. The only change, then, in the ration during the experiment was the change made from one kind of silage to the other. The cows were weighed every morning at a stated time in order that a check might be kept on the gain or loss in live weight for each individual.

The following table gives the results of the experiment:

FIRST TRIAL, 1911-1912.

CORN SILAGE *vs.* CANE SILAGE.

LOT. I.—Four Cows—Twenty-Day Periods.

Period.	Milk.	Butter Fat.	Body Weight.
1. Corn silage in ration	1337	55	4108
2. Cane silage in ration	1252	51	4131
3. Corn silage in ration	1178	49	4106
Av.—1st and 3rd periods, corn silage	1257	52	4108
2nd period, cane silage.	1252	51	4132
Difference	5	1	24

LOT II. Four Cows—Twenty-Day Periods.

Period.	Milk.	Butter Fat.	Body Weight.
1. Cane silage in ration	1192	54	4044
2. Corn silage in ration	1167	51	3953
3. Cane silage in ration	989	46	4020
Av.—1st and 3rd periods, cane silage	1091	51	4032
2nd period, corn silage	1167	51	3953
Difference	76		79

In studying the table of results on lot I, we find that the cows declined in milk and butter-fat production on being changed from the corn to the cane silage. At the same time there was an increase in live weight when the change was made from corn back to cane silage. During the third period, after the cows had been changed from the cane back to the corn silage, they lost in live weight. This shows a direct influence that the feeding of the cane silage had on the live weight. A study of the table giving the average of the first and third periods at the time the cows were fed on the corn silage, and a comparison of this with the second period,when the cows were receiving cane silage, show that the cows gained five pounds in milk and one pound in butter fat on the corn silage. It also shows that the cows, when fed cane silage, made an increase in body weight of twenty-four pounds. The increase made in milk, butter fat, and live weight is the total increase made by the four cows in twenty days. The increase made in milk and fat production in favor of the corn silage is so small as to mean little. In fact, the increase shown here is not much more than a variation that would be caused by change from one feed to another, or a change that would be caused by a change of weather or other such variable conditions. The increase of twenty-four pounds in live weight for the lot is a daily gain of a little more than one-fourth of a pound to the cow for the period, which fact suggests that the cane silage is more fattening than the corn silage.

Lot II made a similar showing. As has been observed, the order of feeding was just the reverse of that in lot I. It will be noticed that here the cows did not make a direct increase in milk when changed from the cane silage to the corn silage, but that there was a direct increase in gains when the change was made. A comparison of the average production of the first and third periods with that of the second period shows that the corn silage produced more milk and butter fat than the cane silage, while the cane silage caused gains in live weight. The four cows made seventy-six pounds more milk and a trifle more fat on the corn silage than on the cane. Each cow produced daily three-fourths of a pound more milk on the corn silage than she did on the cane silage. Here, again, the increase in live weight when the cows were changed from corn to cane silage, suggests that the cane silage is more fattening than the corn silage.

SECOND TRIAL, 1912-1913.

During the winter of 1912-1913, a feeding experiment was conducted with fifteen dairy cows, in which comparison was made of the respective merits of three crops for silage. The general plan of the experiment was similar to the plan carried out the first year. The fifteen cows were divided into three lots. Lot I, of six cows, was used to compare kafir silage with corn silage. Lot II contained five cows, by means of which cane was compared with kafir silage. In Lot III four cows were used to determine the comparative value of corn silage and cane silage. The cattle in each lot were fed for three periods of thirty days each, with a ten-day period intervening between the first and second periods and also between the second and third periods, at which time the changes in feed were made. The experiment included only the thirty days in each period. The grain and the hay ration were kept constant, as described in the other experiment. The only change made was in the kind of silage, the amount of silage being kept constant. The cows were weighed each day and the gain and the loss in live weight were noted.

The following table gives the results of the second trial:

SECOND TRIAL, 1912-1913.

LOT I.—KAFIR SILAGE *vs.* CORN SILAGE.

Six Cows—Thirty-Day Periods.

Period.	Milk.	Butter Fat.	Body Weight.
1. Kafir silage in ration	3373	142	6010
2. Corn silage in ration	3383	140	5994
3. Kafir silage in ration	3339	139	6021
Av.—1st and 3rd periods, kafir silage	3356	140	6015
2nd period, corn silage	3383	140	5994
Difference	27		21

LOT II.—CANE SILAGE *vs.* KAFIR SILAGE.

Five Cows—Thirty-Day Periods.

Period.	Milk.	Butter Fat.	Body Weight.
1. Cane silage in ration	2384	107	4852
2. Kafir silage in ration	2492	112	4879
3. Cane silage in ration	2139	98	4927
Av.—1st and 3rd periods, cane silage	2261	102	4890
2nd period, kafir silage	2492	112	4879
Difference	231	10	11

LOT III.—CORN SILAGE *vs.* CANE SILAGE.

Four Cows—Thirty-Day Periods.

Period.	Milk.	Butter Fat.	Body Weight.
1. Corn silage in ration	1953	89	3743
2. Cane silage in ration	1832	86	3747
3. Corn silage in ration	1852	85	3755
Av.—1st and 3rd periods, corn silage	1902	87	3749
2nd period, cane silage	1832	86	3747
Difference	70	1	2

Results of experiments in lot I, in which kafir silage was compared with corn silage, indicate that corn silage is slightly superior to kafir silage for milk production. The cows showed a loss in live weight, however, when changed from kafir to corn silage. The increase of twenty-seven pounds in milk production in favor of corn is very slight for the lot, as this is the increase of six cows for thirty days, or less than one-sixth of a pound of milk daily to the cow. The kafir silage proved more fattening than the corn silage.

Cane and kafir silage were compared in lot II. The results obtained here are more striking than those secured in the other lots. Kafir silage, according to these results, is much better than cane for milk production. Upon comparison of the production during the periods in which the cows received cane silage with the period in which they received kafir silage, it is found that for a thirty-day period in each case, the five cows produced 231 pounds more milk on the kafir silage than on the cane silage. This means about one and one-half pounds of milk daily to the cow. The cows made a very slight gain in body weight while on the cane silage.

Corn silage was compared with cane silage in lot III. Corn proved superior to cane silage. When the cows were changed to cane silage, they declined in milk production in the second period, as shown in the table; when they were changed back to corn silage in the third period, they showed a general increase in milk. While the cows were on corn silage in the third period, they each produced slightly more than one-half pound more milk per day than they had produced on cane silage. In this trial the cows made a very slight gain in live weight in favor of the corn silage, but this gain is so small as to be negligible.

In summing up the work of both trials, the following conclusions may be drawn:

Corn silage is slightly superior, as a milk producer, to silage made from either kafir or cane.

Kafir silage ranks second as a feed for milk cows.

Cane silage ranks third as a milk producer.

In both trials the cattle gained in live weight on cane silage more readily than on the silage made from kafir or corn. This fact would indicate that it contained more carbohydrates and sugar, or fattening nutrients, than the other feeds. In this experiment the grain and the hay ration were constant, and the only change made in the feeding was in the kind of silage. It is our opinion that cane silage would prove the equal, ton for ton, of corn or kafir silage if the grain ration were changed so that the animal would use the nutrients more economically. This could be done by feeding more protein and less fat-forming nutrients in the grain ration.

Although kafir and cane silage were shown to be slightly less valuable than corn silage from the experiments just explained, there are other factors that must be considered; namely, yield, and adaptability to local conditions. Without doubt, the greater yield of cane and kafir to the acre will offset the slight increase in feeding value obtained from corn silage. Kafir and cane are drouth-resistant crops and can be grown over a wider territory than corn, and from one-third to one-half more tonnage to the acre can be obtained.

During both trials the acidity of the cane silage was never more than that of the corn silage. In the second trial the average acidity for the three different kinds of silage was as follows: corn, 2.03 per cent.; cane, 1.46 per cent.; kafir, 1.43 per cent.

It was also noted during the experiment that most of the cane seed and a great amount of the kafir seed passed through the animals undigested. This suggests that the nutritive value of these crops as silage is to a certain extent limited to the nutritive value of the stalk and leaves.

The quality of silage obtained from all crops was very good. The kafir silage was perhaps the poorest on account of being immature, as the heavy frost forced an early harvest.

The cows ate the silage with relish. The cane silage seemed most palatable.

The silage was stored in wooden-stave and in cement silos. It kept equally as well in cement as in wood.

The time of cutting cane and kafir for silage is all-important in making good silage from these crops. The crops should be practically mature; that is, the seed should be mature. At this time the stalk is still filled with sap and will make good silage. If put up too green, it will make sour silage. The crops should be put up before frost if possible, but it is better to let the crop stand until after frost than to put it up too green. After a heavy frost, the crop should be cut and siloed immediately. If it dries out too much, sufficient water should be added to cause it to pack well.

Kansas State Agricultural College.

EXPERIMENT STATION.—Circular No. 29.

Department of Entomology.

GEO. A. DEAN, *Entomologist in Charge.*

The Chinch-Bug Situation in Kansas[*]

BY

GEO. A. DEAN and J. W. McCOLLOCH.

Had it not been for the army of chinch bugs which invaded Kansas last year, the wheat, oats, and corn crop would have been worth at least seventeen million dollars more than it was. The number of bugs that went into winter quarters last fall was much larger than that of the previous fall. The dry, mild winter enabled fully ninety per cent. of them to pass through the winter successfully, and now since enormous numbers have made their way into fields of wheat, oats, and rye, it renders it almost certain that the brood of young bugs, which will develop in these fields, will assume very dangerous proportions. In fact, all conditions make it almost certain that the farmers of Kansas are facing the most serious outbreak of chinch bugs ever known in the history of the State.

After harvesting time these bugs will be approaching maturity, and since they will be deprived of food by the ripening of the wheat, oats, and rye, they will migrate to the nearest fields that may afford them food. Any field of corn or other grain adjacent to an infested wheat or oats field will be attacked at harvest time unless a prompt and vigorous effort is made to put in operation the methods which are effective in keeping them out. To explain the measures by which this may be effectively accomplished is the object of this circular.

SUMMER MEASURES OF CONTROL.

After the bugs leave their winter quarters and become established in the small-grain fields there is no method of preventing injury to these crops, but by diligent work the corn, kafir, and sorghum crops may be saved from any injury. The problem of summer destruction involves not only the necessity of getting the bugs to pass from the small grains while yet immature, but the necessity of maintaining efficient dust barriers during dry weather or road-oil barriers during wet weather, and the destruction of all bugs that succeed in crossing the barrier and congregate on the first few rows of corn.

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[*] Dr. T. J. Headlee, entomologist of the Kansas State Experiment Station for the five years previous to October 1, 1912, and now state entomologist of New Jersey, made a very thorough and careful investigation of the chinch-bug situation in Kansas. The principal facts and data embodied in this circular are taken from the bulletin manuscript prepared by him and Mr. J. W. McCulloch. This bulletin manuscript has been in the hands of the State printer for several months, but since it will still be a considerable time before it is published, it seems advisable to place in the hands of interested persons the timely information contained in this circular.

Ordinarily the small-grain fields ripen before the bugs are yet mature and they are thus forced to migrate on foot to other fields. Some years, however, the wheat is so delayed in ripening that the bugs are mostly mature before harvest, and in such cases they migrate on the wing and nothing can be done to destroy them. At times, the wheat is so thin on the ground that a growth of grass and weeds furnishes the chinch bugs with food after the wheat ripens, thus allowing them to mature in the wheat fields before moving to corn. In such cases harvest should be hastened and the field should be thoroughly disked to destroy all food for the bugs, and thus hasten the migration.

THE DUST BARRIER.

There are two types of dust barriers; namely, the double furrow and the single furrow. The first is made by plowing a strip about ten feet wide between the infested and non-infested fields and then reducing the soil to a fine dust by harrowing and dragging with a brush drag. Two troughs about four feet long are made of heavy lumber and held about a foot apart by a couple of 2x4-inch pieces nailed firmly across the top. This double trough, heavily weighted down, is dragged back and forth on the plowed strip until two deep, parallel furrows are formed, the sides and bottoms of which are covered with a deep, fine dust.

The single-furrow barrier is made by plowing a deep lister furrow between the infested fields and the non-infested fields. The sides and bottoms of this furrow are reduced to a deep, fine dust by dragging back and forth a heavy log wrapped with a log chain.

The double-furrow barrier requires a little more time to construct, but demands less attention while the bugs are moving. Either type of barrier can be renewed readily by redragging.

After the bugs are caught in these furrows they may be destroyed by either burning with a gasoline torch, crushing with the drags, or by trapping in post holes. The most successful of these methods is to destroy them with a gasoline torch. This is done by flaming the sides and bottoms of the furrows at regular intervals with a strong gasoline torch. Although many bugs may be destroyed by continuous dragging while they are moving, this method has not been found successful, as many bugs are forced out of the furrow. The post-hole method has been found the least satisfactory of all. Holes are dug at intervals of ten feet in the bottoms of the furrows, and the bugs that are caught in these holes are destroyed by pouring kerosene over them. These holes have to be rebored after each dragging of the furrow, and the kerosene makes it hard to work up a dust.

The gasoline-blast-torch method has proved itself to be admirably adapted to our needs, for not only are we able to destroy the bugs by simply passing the flame along the furrow, but the furrows can be repaired as often as necessary by dragging the log or trough through them. The most efficient torch that we have used is known as the "Locust Torch," and is manufactured by the Turner Brass Works of Sycamore, Ill.

ROAD-OIL BARRIER.

The efficiency of the road-oil barrier was first demonstrated by Prof. S. A. Forbes, of Illinois. In giving his results he says: "The most satisfactory results, considering both cost and protection, have been obtained from the line made of No. 7 road oil. This material, when properly applied, caught all the crawling bugs and was easy to maintain. It has been fully demonstrated that, by means of the road-oil line, with traps, and the soap spray, chinch bugs from whatever source can be rendered harmless." In his summary Professor Forbes says: "Its (the chinch bug's) escape from infested fields to other crops can best be prevented by surrounding each field with a line of thick, viscid road oil (No. 7 of the Standard Oil Company), with post holes beside it some thirty feet apart. Such a line can be made and kept effective long enough to catch virtually all the bugs in a field at a minimum expense of thirty-five cents a mile per day."

Road oil No. 7 is manufactured and sold by the Standard Oil Company at $3.50 a barrel, and can be obtained from the Standard Oil Refinery at Whiting, Ind. Professor Forbes found it very advantageous for commercial clubs, local dealers, or distributing agents to handle the oil in carload lots, thus saving much on freight rates and at the same time making sure of having a supply when it is needed.

The road-oil barrier is constructed by plowing a sharp backfurrow between the infested fields and the non-infested ones. Two two-inch planks, about eight feet long and twelve and fourteen inches wide, are nailed together, hog-trough fashion. The front end of the trough is rounded off like a sled runner, and in order that it may slip well the inside of the trough should be lined with galvanized iron. A smooth pole, about two and one-half inches in diameter, is nailed into the bottom in such a manner that it extends from the front end to a point eight inches behind the rear of the trough. A narrow, rectangular platform, running the length of the trough and extending ten inches beyond the rear end, is then constructed on the ridge of the now inverted trough. This platform is intended for carrying the driver and any additional weight that is needed. By means of a strong wire or chain, an attachment is made to the clevis and the inverted trough is ready for work.

This trough is dragged up and down the backfurrow until a compact ridge is formed with a groove along the top of it. The oil is poured along this groove from a sprinkling can, the nozzle of which has been removed, in a stream of sufficient size to make a line one-half to three-fourths of an inch in width.

The bugs are destroyed by flaming along the oil line with the gasoline torch, the same as in the dust barrier. They may also be destroyed by digging post holes at the bottom of the slope on the bug-infested side.

Where it is not possible to obtain road oil, coal tar can be substituted. The high price and scarcity of tar, and the fact that it has to be renewed more frequently, makes it rather objectionable for barriers.

OPERATION OF BARRIERS.

The farmer should keep in touch with what the bugs are doing in the small-grain fields, especially about harvest time, and should have his barrier materials ready for use when the time comes. A small strip between the infested and non-infested fields should be kept free from weeds so that when the barriers are constructed the ground will break up nicely and be easily pulverized. It is necessary for the farmer to plan to use both types of barriers. At the first signs of migration the dust barrier should be constructed, if the weather is dry, and the ridge for the road-oil barrier should be prepared. The road-oil barrier should be placed between the dust barrier and the field to be protected, but the oil should not be placed on the barrier until, owing to wet weather, it is impossible to hold the bugs in the dust barrier.

Harvest should start as early as possible so that the bugs will have to pass without delay. During the migration of the bugs there must be one person for each one-half to three-fourths of a mile of barrier in the field constantly burning or otherwise destroying the bugs that are caught in the barriers. Ordinarily the migration of chinch bugs from wheat to corn fields covers a period of from one to two weeks, depending on the amount of food left in the wheat field after harvest. We have found in our barrier work that for the most part the bugs move during the afternoon. Generally they begin passing about 4:00 p. m., reach the maximum between 5:00 and 5:30 p. m., and cease entirely about 7:00 p. m. During the entire period of migration in 1912 it was necessary to attend the barriers on an average of about four hours per day. On one or two cool days the bugs began migrating about 9:00 a. m., but the real migration did not begin until afternoon.

RESULTS OF BARRIER WORK IN 1912.

Last year the dust barrier and gasoline torch were given a thorough trial on the Experiment Station farm. A furrow two miles long was plowed between all wheat and corn fields. This furrow was six to eight inches deep and was dragged with a heavy log wrapped with a log chain until the sides and bottom of it were reduced to a fine dust. This barrier was in constant use for fifteen days.

Harvest began June 25, and from then on until July 8 the ground was black every afternoon with moving bugs. With the beginning of the heavy migration of bugs the management of the barriers was more or less systematized. The barriers were thoroughly dragged every day before 2:00 o'clock and then gone over with a hoe and all clods, sticks, and rubbish removed from the furrow. Two men were employed to operate the two torches, which were used continuously every day from 3:00 to 7:30 p. m. On two or three cool and partially cloudy days it was necessary to flame the furrows several times in the morning, and on a couple of days, when the migration was heaviest, it was necessary to use three torches for an hour or two. Ordinarily one man with a torch can protect one-half to one mile of barrier.

At no time during this migration did more than one bug in a thousand get across the barrier, and most of the time the per cent. was lower than this. Not a single row of corn was injured by the bugs, while in nearby fields where no barriers were used as high as two hundred rows of corn were entirely destroyed. The cost of constructing and maintaining the two miles of dust barrier is itemized as follows:

Plowing furrow, 1 man and team, 5 hours	$ 2.10
Dragging to get dust, 1 boy and horse, 6 hours	1.50
Dragging to keep barrier in shape, 1 boy and horse, 5 hours a day for 15 days	18.50
Running torches, 2 men, 4 hours a day for 15 days	24.00
Running torches, 1 man, 4 hours a day for 4 days	3.20
Gasoline, 140 gallons, at 11 cents	15.40
Total	$64.70

Owing to rain on July 1 and 5, the road-oil barriers were used for about three days. Post holes and torches were used in destroying the bugs, but the post holes did not prove effective except where a ridge of dust was worked up around the holes, causing the bugs to roll in and also preventing them from crawling out again. The use of the gasoline torch proved very successful, except that it served to dry out the oil. As a whole, the oil barrier did not prove as efficient as the dust barrier. As high as ten bugs out of every thousand were able to get across. It required constant watching to keep grass and rubbish from blowing onto it and forming a bridge for the bugs to cross. It is to be recommended, however, when wet weather prevails. The cost of maintaining the oil barrier was as follows:

Throwing up ridge and shaping, 1 man and team, 6 hours,	$ 2.55
Spreading oil, 35 hours at 20 cents per hour	7.00
Running torches, 2 men, 4 hours per day, 3 days	4.80
Keeping barrier in shape, 1 man, 4 hours per day, 3 days	2.05
Road oil No. 7 for 2 miles, 115 gallons at 6¼ cents	7.20
Gasoline for torches, 24 gallons, at 11 cents	2.65
Total	$26.25

DESTROYING BUGS THAT CROSS THE BARRIERS.

It is impossible to keep all the bugs from getting over the barriers, and these bugs begin work on the first rows of corn. In our work during the last two years we have found it possible and practical to destroy these bugs by spraying with a soap spray or by flaming the corn with the gasoline torch.

The soap spray is made by dissolving eight pounds of laundry soap in fifty gallons of water, and may be applied with any form of sprayer. In our work we have found the small knapsack sprayer very satisfactory for spraying corn. Since this spray kills the bugs only when it comes in actual contact with them, it must be applied in such a manner as to thoroughly wet the bugs. To do this it is necessary to fill the pockets formed by the leaves and the stem by drenching the plant, but care should be taken to keep the liquid out of the growing curl. The bugs must be destroyed shortly after they cross the barrier or they will soon distribute themselves over the field.

Where it is impossible to spray, the flaming of the infested rows with the gasoline torch is to be recommended. Careful tests have shown that practically all the bugs on the corn plants can be destroyed by flaming the plants, but the corn is seriously injured by this treatment.

THE ARTIFICIAL DISTRIBUTION OF THE CHINCH-BUG FUNGUS.

During the past five years the Department of Entomology of Kansas State Experiment Station made a careful study of the fungous disease **(Sporotrichum globuliferum)** which attacks the chinch bugs, and in every part of the State where the bugs have been in sufficient numbers to do injury the fungous disease was present. In other words, the disease has been found commonly distributed over the entire bug-infested districts of the State, attacking not only the chinch bug, but a large number of other species of insects. However, it should be stated that although the fungous disease seems everywhere to be present, the proper climatic conditions must be had in order for it to propagate; namely, plenty of moisture and summer temperatures. If these favorable conditions are had, the fungus will break out; and if the bugs are abundant, it will soon disseminate among them and sweep them off in great numbers.

In 1910 the University of Kansas made a careful investigation of the value of artificial distribution of the chinch-bug disease. The following statements are quoted from the conclusions derived from this investigation:*

"The chinch-bug fungus is present naturally in fields everywhere throughout the infested area in Kansas.

"It is present in such great abundance that any artificial distribution of infection in the field would be too insignificant, by comparison, to be of practical use.

"Its distribution naturally through a field is much more uniform than any artificial distribution can be made.

"The amount of fungus used experimentally in both wheat and corn fields was so far in excess of any that would be used by the farmer in infecting his own fields that he could not reasonably expect to succeed.

"Apparent absence of fungus among chinch bugs in a field is evidence of unfavorable conditions rather than lack of the fungous spores.

"Spent adult chinch bugs succumb to attack more readily than younger ones, but as the old bugs have finished depositing their eggs, their loss by fungous disease accomplishes little else than increasing the amount of the infectious material.

"Advocating artificial infection or encouraging it by sending out diseased chinch bugs does not serve the best interests of the farmer, since his attention is thus diverted from other and more efficient methods of combating the pests."

Thus it appears from the above facts that the artificial distribution of this fungous disease amounts to nothing, and even with favorable conditions the artificial introduction will not hasten the action of the fungus.

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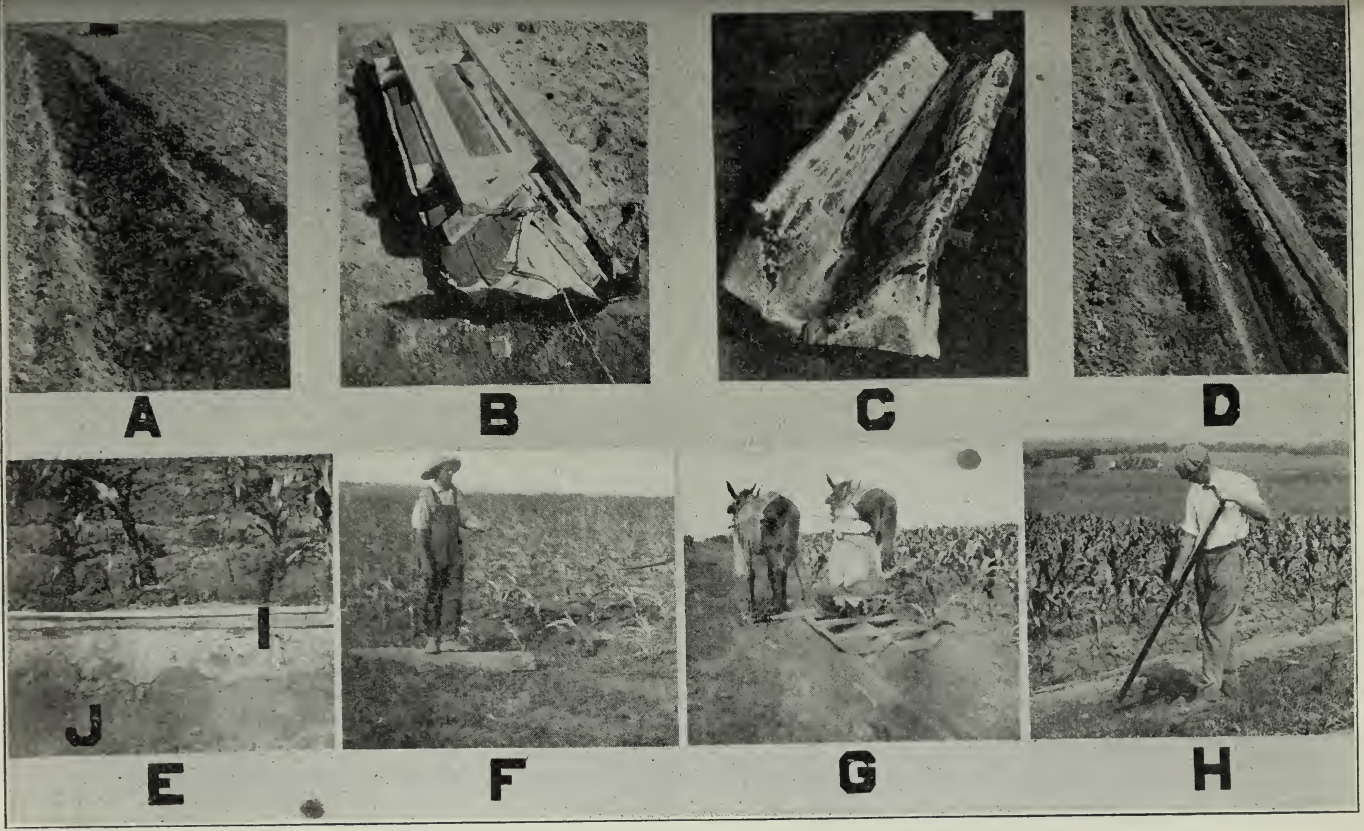
* Bulletin 107, Bureau of Entomology, United States Department of Agriculture, page 45.



METHODS OF CONSTRUCTING AND OPERATING BARRIERS.

A—Backfurrow for road-oil barrier; *B* and *C*—Top and inverted views of trough for shaping ridge for road-oil barrier; *D*—Completed road-oil barrier; *E*—Close view of road-oil barrier showing (I) size of oil line in comparison with hoe handle and (J) ridge; *F*—Dragging to get dust in single-furrow dust barrier; *G*—Dragging to get dust in double-furrow dust barrier; *H*—Destroying bugs by flaming dust barrier with the "Locust Gasoline Torch." (After T. J. Headlee.)

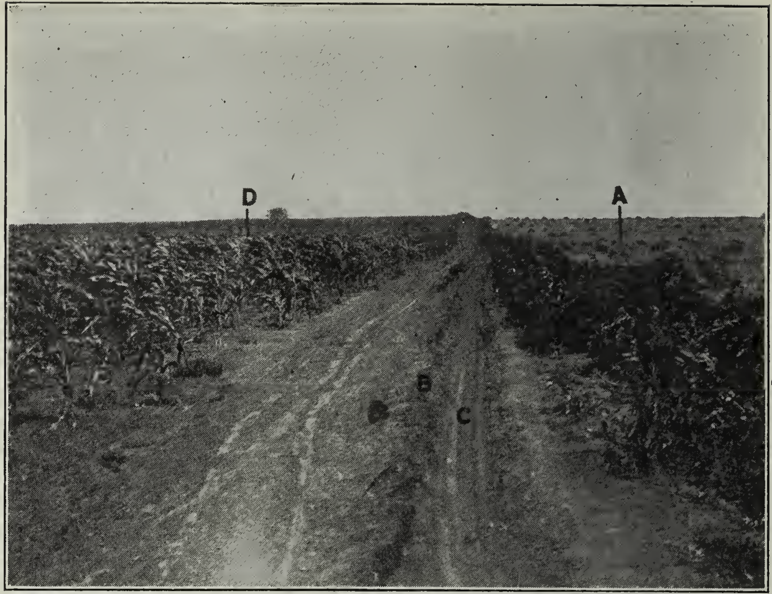


FIG. 1.—A protected corn field. *A*—The infested wheat field; *B*—Road-oil barrier; *C*—Single-furrow dust barrier; *D*—The protected corn field. Note that not a single hill of corn is injured. (After T. J. Headlee.)

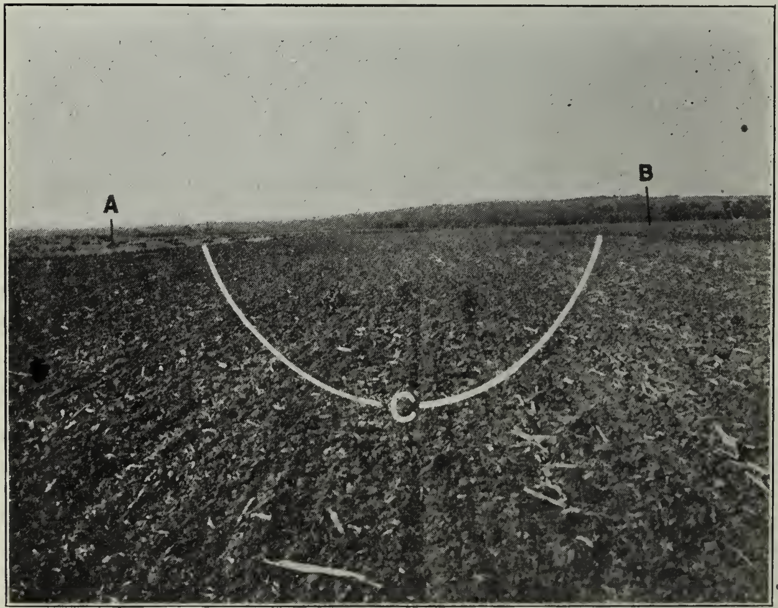


FIG. 2.—An unprotected corn field. *A*—The infested wheat field; *B*—Corn field where bugs were working when picture was taken; *C*—Area of corn field completely destroyed within five days after bugs began migrating. One hundred rows of corn were completely destroyed. (After T. J. Headlee.)

Kansas State Agricultural College.

EXPERIMENT STATION—Circular No. 30.

Feed Control Section.

The Kansas Feeding-Stuffs Law Revision of 1913.

REGULATIONS AND EXPLANATIONS.

WHAT FEEDS DO NOT REQUIRE REGISTRATION AND LABEL.

1. Whole seeds or grains.
2. Whole hays, straws, and corn stover, when not mixed with other material.
3. Cottonseed cake, cottonseed meal, or other cottonseed products.
4. All other materials containing sixty per cent or more of water.

WHAT FEEDS MUST BE REGISTERED AND LABELED.

1. All feeds except those mentioned above require registration and label. Some of the common feeds requiring registration and label are: Corn chop, kafir chop, oats chop, ground, cut, or chopped alfalfa, bran, shorts, mill run, corn bran, corn chop and bran mixed, corn-and-cob meal, bran and screenings, mill run and screenings, shorts and screenings, oil meal, meat meal, bone meal, blood meal, tankage, all poultry feeds, all mixed feeds, etc.

INFORMATION REQUIRED UPON THE LABEL.

1. Principal name and address of person or firm responsible for placing the feed upon the market.
2. Minimum **net** weight of the contents of the package.
3. Name, brand, or trademark of the feed.
4. The guaranty:

Protein, not **less** than.............%.
Fat, not **less** than ....%.
Crude fiber, not **more** than ....%.

5. The specific name of each ingredient used in manufacturing the feed.

(In case any adulterant mentioned in Section 12 of the law is added to the feed, the maximum per cent must be stated upon the label. In this connection attention is called to the fact that unwholesome or injurious materials must not be used in the manufacture of feeds.)

A good form of label is as follows:

99 Lbs. Net Weight
I. X. L. FEED
Composed of
Alfalfa, Corn Chop, Kafir Chop, Wheat Bran, and not
over 5% of Corn Bran.
GUARANTY
Protein, not less than 14.5%
Fat, not less than 3.7%
Crude Fiber, not more than 20.3%
Manufactured by
JOHN DOE MILLING CO.,
Doeville, Kan.

WHEN DO REGISTRATIONS EXPIRE.

1. All registrations expire on June 30 of the fiscal year during which they are filed.

REGISTRATION FEE.

1. Flour mills having capacity to manufacture more than three hundred barrels of flour in each twenty-four hours are required to pay an annual registration fee of $12.50 for each brand of feeding-stuff sold in this State.

2. Flour mills having capacity to manufacture more than fifty barrels and not to exceed three hundred barrels of flour in each twenty-four hours are required to pay an annual registration fee of $10 for each brand of feeding-stuff sold in this State.

3. Flour mills having capacity to manufacture not to exceed fifty barrels of flour in each twenty-four hours are required to pay an annual registration fee of $5 for each brand of feeding-stuff sold in this State.

4. Registration fee for chop or feed mills will be calculated on the above basis.

5. In case the same brand is manufactured at more plants than one, a separate registration fee shall be paid as herein provided on said brand for each separate manufacturing plant.

CHANGES IN COMPONENTS OR IN GUARANTY.

1. Before any changes can be made in the components or in the guaranty of any registered feed, application for permission to make such change must be made to the Feed Control Section. If the reasons given for making the change are deemed satisfactory, permission will be granted.

DEFINITION OF THE TERM "BRAND."

1. "The term 'brand', as used in this act, is to be taken to mean: First, the name, trademark, or other designation under which a commercial feeding-stuff is sold; and second, the feeding-stuff itself."

It should be noted that separate registration will be required upon the various brands or grades of shorts.

DEFINITION OF COMMERCIAL FEEDS.

1. **Wheat Bran.** The coarse outer coating of the wheat kernel as separated in the usual process of commercial milling from cleaned and scoured wheat.

2. **Bran and Screenings.** If to the wheat bran be added, either ground or unground, the various impurities separated from the wheat during the cleaning process and known collectively as **screenings,** the same shall constitute a mixed feed and must be registered, labeled, and sold as **bran and screenings.**

3. **Screenings.** The smaller, imperfect grains, weed seeds, and other foreign materials having a feeding value, separated in cleaning the grain. They shall be designated by the name of the grain from which they are derived.

4. **Standard Shorts.** The fine particles of the outer bran, the inner or "bee-wing" bran, germ, and the offal or fibrous material obtained in the last reductions on middlings.

5. **Brown Shorts.** As compared with standard shorts, this contains mostly fine particles of bran with much less of fibrous offal obtained from the "tail of the mill."

6. **White Shorts.** As compared with standard shorts, this brand contains a smaller portion of the bran particles and a much greater portion of fibrous offal from the "tail of the mill."

7. **Shorts and Screenings.** If to the shorts be added, either ground or unground, bolted or unbolted, the various impurities separated from the wheat during the cleaning process and known collectively as **screenings,** the same shall constitute a mixed feed and must be registered, labeled and sold as shorts and screenings.

8. **Mill Run.** A mixture consisting of wheat bran and standard shorts combined in the proportions obtained in the usual process of commercial milling. Feed sold as mill run must consist of bran, plus the standard shorts or the total feed. It does not consist of bran, plus brown shorts only.

9. **Mill Run and Screenings.** If either bran and screenings, shorts and screenings, or both, enter into the composition of mill run, it must be registered, labeled, and sold as "Mill Run and Screenings."

10. **Shipstuff.** (See Shorts.)

11. **Corn Bran.** The outer coating of the corn kernel as produced in the usual process of commercial milling.

12. **Chop.** Composed wholly of ground, cut, or chopped kernels from which no portion has been abstracted for the manufacture of other substances, and to which no other substance has been added.

13. **Hominy Feed.** The bran coating and germ of the corn kernel, and it may contain a part of the starchy portion of the kernel.

14. **Alfalfa Meal** is ground, cut, or chopped alfalfa from which no portion has been abstracted for the manufacture of other substances, and to which no other substance has been added. It may be either fine or coarse.

15. Blood Meal is finely ground dried blood.

16. Meat Meal is finely ground meat scraps. If it bears a name descriptive of its kind, composition, or origin, at must correspond thereto.

17. Digester Tankage is meat scraps from edible carcasses which have been inspected and passed as satisfactory for human consumption, specially prepared for feeding purposes through tanking under live steam, drying under high heat and suitable grinding.

CAUTIONS.

Careful observation of the following points will enable you to avoid more or less difficulty in registering your feeds and otherwise complying with the law:

1. **Be sure to fill in carefully and properly all spaces on the application blank.**

2. Do not register under firm name and then use some other name on label.

3. In filling in name of brand, use the exact name which you expect to place upon your label. For example, do not register wheat shorts and then expect to sell "brown shorts," "white shorts," or "white middlings" under this registration.

4. Give the name of each ingredient used in making up the feed.

5. When the term "bran" is used without any qualifying word, it will be assumed that it refers to **wheat** bran only.

6. In making up samples for analysis, small samples should be taken from a number of different sacks, or taken from the spout at different times during the run. These samples should be thoroughly mixed and an average sample consisting of at least two pounds be forwarded for analysis.

7. In making up the guaranty from results of analysis, the percentages of protein and fat should be slightly lowered and the percentage of crude fiber should be raised somewhat to provide for differences in composition of the raw material or slight variations in the manufacturing process.

8. Manufacturers having difficulty in determining proper guaranties are invited to write to the Feed Control Section regarding this difficulty.

9. Keep a record in your office of all feeds registered, together with their components and guaranties.

10. Be sure that all feeds leaving your plant are properly registered and labeled.

11. Dealers should see that all feeds are properly labeled before exposing them for sale. When tags are torn off in handling, duplicate tags must be attached.

CHANGES IN THE LAW.

1. Condimental or medicated stock foods, proprietary medicines, etc., are placed under separate law known as "Live Stock Remedy Law."

2. The specific name of each ingredient must be stated on the label. In case the feed is adulterated with any foreign mineral matter, or other foreign substance such as rice hulls, chaff, corn-cob meal, corn bran, oat hulls, oat clippings, or other materials of less or of little or no feeding

value, the kind and maximum amount of such mixture must be stated upon the label.

3. All whole meals or chops must be registered and labeled.

4. All cottonseed products are exempted by amendment offered in the legislature.

5. **Tonnage Tax.** A tax tag, or label, purchased from the Feed Control Section must be attached to each package, lot, or parcel of the following feeds: All poultry foods, linseed oil meal, linseed oil cake, or the feeding-stuff by-products of starch factories, glucose factories, cereal breakfast food factories, breweries and distilleries, meat packing establishments, or slaughter houses. **No registration fee** is required on these products. However, each application for registration **must be accompanied** by an order for $5 worth of tags for each brand offered for registration. If it is desired that tags or labels be sent by mail, postage must be included in the order.

APPLICATION BLANKS.

1. All applications for registration must be made on blanks furnished by the Feed Control Section. Each application must be accompanied by the necessary registration fee, made payable to the Feed Control Section, or, in case of feeds on tonnage tax basis, by an order for not less than five dollars' worth of stamps or tags for each brand of feed registered.

REGISTRATION SAMPLES.

1. Samples of all feeds must be sent prepaid with the application for registration. A registration sample should consist of at least one pound.

COPY OF LABEL.

1. In order to avoid misunderstandings, it is requested that a sample tag, or copy of the label required by Section 2 of the law, be submitted with each application for registration.

ANALYSIS OF SAMPLES.

1. If the manufacturer or seller desires the Experiment Station to make chemical analysis of sample to determine fat, protein, and fiber required in the guaranty, this work will be done at the following rates: Charge for determining fat $2, protein $2, crude fiber $4, or all three for $5. The Experiment Station does not guarantee that the analysis made of samples submitted by a manufacturer or seller is representative of the product sold by each manufacturer or seller. The Station merely guarantees that the composition of the sample submitted is as reported. Manufacturers and sellers taking samples for analysis should be extremely careful to secure a representative sample. Their attention is called to Caution 5 for directions in taking such samples.

TABLE OF ANALYSES OF MILL PRODUCTS AT KANSAS STATE AGRICULTURAL COLLEGE, 1913.

COMMODITY	Protein			Fat			Crude Fiber			Number of Samples
	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	
Bran	20.8	14.1	16.6	4.7	3.4	4.1	12.1	6.6	9.6	31
Bran and Screenings	18.9	12.9	16.4	4.8	3.3	4.1	12.2	7.2	10.2	37
Mill Run	19.8	16.2	17.8	4.4	3.7	4.1	10.3	7.6	8.7	8
Mill Run and Screenings	18.3	16.2	17.6	4.5	4.0	4.2	9.6	7.2	8.6	6
Shorts	21.4	14.4	17.9	5.7	3.2	4.3	9.5	2.5	5.8	37
White Shorts	19.5	12.9	17.2	4.5	2.0	3.6	5.9	2.4	4.5	11
Gray Shorts	18.7	17.3	18.2	4.7	4.2	4.5	7.4	6.4	6.8	4
Brown Shorts	20.6	17.6	19.1	5.0	4.5	4.7	7.5	5.2	6.5	3
Shorts and Screenings	19.2	17.6	18.4	4.7	4.4	4.5	7.5	5.7	6.9	6
Corn Bran	12.8	6.4	9.7	9.8	2.5	6.6	15.7	3.5	10.4	16
Corn Chop	9.8	9.2	9.4	3.8	2.3	3.1	4.4	2.1	3.1	4
*Kafir	......	......	9.9	......	......	2.8	......	......	2.5	19

CORRESPONDENCE.

1. All correspondence relating to the registration of feeding-stuffs should be addressed to the Feed Control Section, Experiment Station, Manhattan, Kan.

PURPOSE OF THE LAW.

1. The whole intent and purpose of the Feeding-stuffs Law is to compel each feed to be sold for exactly what it is and upon its own merits. A consumer is entitled to know what he is buying and paying for. A manufacturer, or dealer, is entitled to know what is being sold. The fact that a feed is registered is evidence that it contains nothing harmful, if properly used. The declaration of the manufacturer must be true to fact if the feed is registered. The inspection and analysis at frequent intervals informs the director of the Experiment Station of the reliability of the manufacturer's or seller's guaranty. If the feed does not come up to the guaranty, the license will be revoked. The law is a protection to the consumer, dealer, and manufacturer.

June 21, 1913.

W. M. JARDINE,
Director.

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* Quoted from U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin No. 203.

CHAPTER 188.

CONCERNING THE MANUFACTURE AND SALE OF COMMERCIAL FEEDING-STUFFS.

House Bill No. 630.

AN ACT regulating the sale of commercial feeding-stuffs; defining same; providing for their registration, labeling, inspection, and analysis; prohibiting the sale of fraudulent or adulterated commercial feeding-stuffs; providing for guaranties regarding composition and ingredients; providing for the affixing of labels or stamps to the packages thereof as evidence of the registration, net weight, and guaranty thereof; providing for the collection of annual registration fees and inspection taxes from the manufacturers of or dealers in these commercial feeding-stuffs; providing penalties for the violation of the provisions of this act; authorizing the expenditure of the funds derived from the registration and inspection fees; and, repealing all laws or parts of laws in conflict therewith.

Be it enacted by the Legislature of the State of Kansas:

SECTION 1. The term, "commercial feeding-stuff" shall be held to include all the feeding-stuffs used for feeding live stock and poultry, except cotton seed meal, cotton seed cake, and other cotton seed products be exempted: (a) Whole seeds or grains; (b) whole hays, straws, cottonseed hulls and corn stover when unmixed with other materials; and (c) all other materials containing sixty per cent. or more of water.

SEC. 2. Every lot or parcel of commercial feeding-stuff sold, offered or exposed for sale, or distributed within this state, shall have a tag or label affixed thereto, in a conspicuous place on the outside thereof, bearing a legible and plainly printed statement in the English language, clearly and truly certifying: (a) The name and principal address of the manufacturer or person responsible for placing the commodity on the market; (b) the minimum net weight of the contents of the package, lot, or parcel; (c) the name, brand, or trade-mark of the feeding-stuff contained therein; (d) the minimum per centum of crude protein; (e) the minimum per centum of crude fat, (f) the maximum per centum of crude fiber contained in the feeding-stuff; and (g) the specific name of each ingredient used in its manufacture. The crude protein, crude fat, and crude fiber shall be determined according to the official methods of the Association of Official Agricultural Chemists of North America in force at the time.

SEC. 3. Before any manufacturer, importer, jobber, firm, association, corporation, or person shall sell, offer or expose for sale, or distribute in this state any commercial feeding stuff, he shall file annually for registration with the director of the Agricultural Experiment Station of the Kansas State Agricultural College, at Manhattan, Kansas, a certified copy of the statement specified in section 2 for each brand of such commercial feeding-stuff; said certified copy to be accompanied, when the said director of the Agricultural Experiment Station shall so request, by a sealed package containing at least one pound of such commercial feeding-stuff to be sold, offered for sale, or distributed in this state; and the company or person furnishing said sample shall thereupon make affidavit that the said sample is representative and a true sample of such commercial feeding-stuff offered for registration. The term "brand" as used in this act, is to be taken to mean: First, the name, trademark or other designation under which a commercial feeding-stuff is sold; and second, the feeding stuff itself.

SEC. 4. The said director shall have power to refuse to register any commercial feeding-stuff under a name, brand, or trade-mark, which would be misleading or deceptive, or which would tend to mislead or deceive as to the materials of which it is composed, or when the specific name of each and all ingredients used in its manufacture are not stated. He shall also have the power to refuse to register more than one commercial feeding-stuff under the same name or brand when offered by the same manufacturer, importer, jobber, firm, association, corporation, or person. Should any commercial feeding-stuff be registered in this state in violation of any of the provisions of this act, the said director shall have the power to cancel such registration. The said director shall refuse to allow any manufacturer, importer, jobber, firm, association, corporation, or person, to lower the guaranteed analysis or change the ingredience of any brand of his or their commercial feeding-stuff, registered for sale in this state unless satisfactory reasons are presented for making such change or changes.

SEC. 5. Each and every manufacturer, importer, jobber, firm, association, corporation or person manufacturing or selling any cotton-seed meal, cotton-seed cake, linseed oil meal, linseed oil cake, or feeding-stuff by-products of starch factories, glucose factories, cereal breakfast food factories, breweries and distilleries, meat packing establishments or slaughter houses, and all poultry foods, cotton seed meal, cotton seed cake, and other cotton seed products be exempted: shall pay to the director of the agricultural experiment station of the Kansas State Agricultural College at Manhattan, Kansas an inspection tax or fee of 10 cents per ton for each ton of such commercial feeding-stuff sold, offered or exposed for sale or distributed in this state and shall deliver with each lot shipped in bulk and affix to each parcel of the above named commercial feeding-stuffs, a tax tag, stamp or label to be furnished by the said director stating, that all charges in this section have been paid. Provided, that such tags, stamps or labels shall be issued to cover twenty-five, fifty and one hundred pounds.

Whenever any of the above named commercial feeding-stuffs is offered or exposed for sale in bulk or otherwise stored, the manufacturer, importer, jobber, firm, association, corporation or person keeping the same for sale shall keep on hand cards upon which shall be printed the statement required by the provisions of section 2, and when any person, firm or corporation shall sell or deliver any such feeding stuffs to another to be kept for sale at retail in bulk or package, such person, firm, or corporation shall furnish therewith, sufficient tax tags or stamps to cover all sales there after to be made of such feeding stuffs and whenever any such feeding stuff shall be sold at wholesale or retail in bulk or package, the person, firm or corporation selling the same shall deliver there-with, a tax tag or stamp showing the payment of the tax required by this section, and upon request a card upon which shall appear the statement required by the provisions of section 2.

SEC. 6. Each and every manufacturer, importer, jobber, firm, association, corporation or person who shall sell, offer or expose for sale, or distribute within this state any brand of commercial feeding-stuff other than those mentioned in section 5, cotton seed meal, cotton seed cake, and other cotton seed products be exempted: shall pay to the director of the agricultural experiment station of the Kansas State Agricultural College at Manhattan, Kansas, an annual registration fee of $10.00 for each brand of commercial feeding stuff sold, offered or exposed for sale or distributed within this state and in case the same brand is manufactured at more plants than one, a separate registration fee shall be paid as herein provided on said brand for each separate manufacturing plant. Provided, that flour mills having the capacity to manufacture more than three hundred barrels of flour in each twenty-four hours, shall pay an annual registration fee of $12.50 for each brand of such feeding stuff. Provided further, that flour mills having the capacity to manufacture fifty barrels or less of flour in each twenty-four hours, shall pay an annual registration fee of $5.00 for each brand of such feeding stuff.

SEC. 7. The money for said tags, stamps or labels, shall be forwarded to the said director of the agricultural experiment station of the State Agricultural College at Manhattan, Kansas and such money together with the money derived from the registration of brands as herein before provided shall be paid into the state treasury monthly and the same is hereby reappropriated to the Kansas State Agricultural College for the purpose of carrying into effect the provisions of this act including the employment of inspectors, chemists, clerks, stenographers, the purchase of chemicals, apparatus and other supplies, expenses incurred in traveling, in procuring samples, in printing bulletins and in giving results of the commercial-feeding stuffs inspection as provided for in this act. If any balance remains unexpended at the close of any fiscal year, the same shall be expended for the purpose of producing, inspecting and distributing pure seed of cereals and alfalfa. The state auditor is hereby authorized to draw warrants upon the state treasurer for any money paid in and received under the provisions of sections 5 and 6 of this act upon presentation to him of properly itemized and duly verified vouchers, approved by the board of regents of the Kansas State Agricultural College.

SEC. 8. Whenever a manufacturer, importer, jobber, firm, association, corporation or person, manufacturing or selling a brand of commercial feeding stuff shall have filed the statement required by section 3 of this act, and paid the inspection tax or the annual registration fee as required by sections 5 and 6 of this act, no other agent, importer, jobber, firm, association, corporation or person shall be required to file such statement or pay such tax or fee upon such brand.

SEC. 9. The said director is authorized in person or by deputy to have free access to all places of business, mills, buildings, vehicles, cars, vessels, and parcels of whatsoever kind used in the manufacture, transportation, importation, sale or storage of any commercial feeding-stuff, and shall have the power and authority to open any parcel containing, or supposed to contain, any commercial feeding-stuff, and to take thereform in the manner prescribed in section 10, samples for analysis. He shall tender therefor the retail price of the sample, or samples, procured. In so far as it is practicable and the revenues provided by this act may suffice, it shall be the duty of said director to annually cause to be analyzed at least one sample so taken of every commercial feeding-stuff that is sold, offered or exposed for sale, or distributed in this state.

SEC. 10. An official representative sample of each brand of commercial feeding-stuff sold, offered or exposed for sale, or distributed within this state shall be taken by the said director of the Agricultural Experiment Station, or his duly authorized representative in the presence, when practicable, of at least one witness. No action shall be maintained for a violation of the provisions of this act, based upon an analysis of a sample from less than five separate original packages, except there be less than five separate original packages in the lot, in which case portions for the official sample shall be taken from each original package; if the commercial feeding-stuff is in bulk, portions shall be taken from not less than five different places in the lot; provided, that this does not exclude sampling in bulk when not exposed sufficiently to take portions from five different places, in which case portions are to be taken from as many places as practicable. If the sample thus secured is larger than is required, it shall be mixed and quartered intil a sample of suitable size remains. All official samples shall be sealed for delivery to said director, who shall cause them to be analyzed, and the result of such analysis, together with such additional information as the said director may deem advisable, shall be promptly transmitted to the manufacturer or person responsible for the placing of the commodity on the market, and shall be published in reports or bulletins from time to time. If the manufacturer or person responsible for placing upon the market any commercial feeding-stuff so sampled be unable to secure a sample of the package or lot of commercial feeding-stuff in question, he shall, upon request to the director of the Agricultural Experiment Station, be furnished with a portion of the official sample referred to in this section. The methods of analysis shall be the methods of the Association of Official Agricultural Chemists of North America in force at this time.

SEC. 11. If it appears that any of the provisions of this act have been violated, the said director shall certify the facts to the proper prosecuting attorney and furnish that officer with a copy of the results of the analysis or other examination of such feeding-stuffs duly verified by the analyst or other officer making the determination. In all prosecutions arising under the provisions of this act, certificates of the analyst or other officer making the examination or analysis, when duly sworn to by such officer, shall be *prima facie* evidence of the fact, or facts, therein certified.

SEC. 12. Any manufacturer, importer, jobber, firm, association, corporation, or person who shall sell, offer or expose for sale, or distribute in this state any commercial feeding-stuff, cotton seed meal, cotton seed cake, and other cotton seed products be exempted: without having attached thereto or furnished therewith such tax stamps, labels, or tags as required by the provisions of this act; or who shall use the required tax stamps, labels or tags a second time, or use a counterfeit of such tax stamps, labels or tags, or who shall impede, obstruct, hinder, or otherwise prevent or attempt to prevent said director of the Agricultural Experiment Station or his authorized agent in the performance of his duty in connection with the provisions of this act; or who shall sell, offer or expose for sale, or distribute in this state any commercial feeding stuff as defined in section 1, without complying with the requirements of the provisions of this act; or who shall sell, offer or expose for sale, or distribute in this state any commercial feeding-stuff which contains a smaller per centum of crude protein or crude fat or a larger per centum of crude fiber than is certified to be contained therein; or who shall sell, offer or expose for sale, or distribute within this state without truly stating the specified name of each and every ingredient used in its manufacture, as required by section 2 of this act; or who shall sell, offer or expose for sale, or distribute within this state any commercial feeding-stuff that has been adulterated with foreign mineral matter, or other foreign substance, such as rice hulls, chaff, mill sweepings, weed seeds, peanut shells, corn cob meal, corn bran, oat hulls, oat clippings, or other materials of less or of little or no feeding value, without plainly stating in the label hereinbefore described the kind and maximum amount of such mixture, shall be deemed guilty of a violation of the provisions of this act and upon conviction thereof shall be fined not more than one hundred dollars ($100.00) for the first violation and not less than one hundred dollars ($100.00) for each subsequent violation. Penalties recovered under this act shall be covered into the school fund of the county wherein the offense was committed.

Any manufactuer, importer, jobber, firm, association, corporation, or person who shall mix or adulterate any feeding-stuff with any substance or substances injurious to the health of live stock or poultry shall be deemed guilty of a violation of the provisions of this act, and in addition to the penalty provided in this section, the lot of feeding-stuff shall be subject to seizure, condemnation, and sale as the court may direct; the proceeds of such sale to be covered into the state feeding-stuff fund. The court may, in its discretion, release the feeding-stuff so seized when the requirements of the provisions of this act have been complied with, and upon payment of all costs and expenses incurred by the state in any proceedings connected with such seizure.

SEC. 13. The director of the Agricultural Experiment Station of the Kansas State Agricultural College is hereby empowered to enforce the provisions of this act and to prescribe the form of tags, stamps, or labels to be used to show that the inspection tax or fee has been paid, and to prescribe and enforce such rules and regulations necessary to carry into effect the full intent and meaning of this act. It is provided that the said director shall not be required to sell tags, stamps or labels in less amount than to the value of five dollars ($5.00) for any one commercial feeding-stuff; provided, further, that the said director shall not be required to register any commercial feeding-stuff unless the certificate is accompanied by an order and fees for tax tags, stamps, or labels to the value of five dollars ($5.00) or some multiple of five dollars for each commercial feeding-stuff offered for registration; provided, further that such tax tags, stamps, or labels are good until used.

SEC. 14. All laws or parts of laws in conflict with the provisions of this act are hereby repealed.

SEC. 15. This act shall be published in the statute book and shall take effect and be in force on and after July 1, 1913.

Approved March 17, 1913.

KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Experiment Station.

Circular No. 31.

DEPARTMENT OF AGRONOMY.

SEED CORN FOR KANSAS.

By L. E. CALL, Agronomist.

Kansas plants, on the average, over one million bushels of seed corn annually. Because of the large increase in the amount of wheat seeded last fall, the acreage of corn in 1914 will probably be below normal. The quantity of seed required will probably be between 800,000 and 900,000 bushels.

Kansas produced in 1913 about 18,000,000 bushels of corn, which is only 12 per cent of the normal crop. Very little of this corn is fit for seed. Because of the drouth and heat it did not mature properly, and even where yields of from five to ten bushels to the acre were obtained the corn produced is, as a rule, inferior in quality and vitality. While much of it may germinate, it lacks the vigor and vitality necessary to obtain a good stand of strong, vigorous plants.

A large per cent of the seed corn for next year's planting must come from sources other than the Kansas 1913 crop. Probably the best source of seed for any given locality is the home-grown 1912 crop. This crop was above normal in quality, and where the corn has been kept under proper conditions it will make good seed. If the corn is of good vitality, it will undoubtedly be superior to seed introduced from other states, or from distant localities within the state. In all probability enough good seed can be selected from the 1912 crop, together with a little good seed obtained in 1913, to supply the needs of the state, but to do this the seed must be selected at once and put on the market and properly distributed.

The Agronomy Department of the Kansas State Agricultural College is endeavoring to assist farmers who have a surplus amount of seed for sale in finding a market and at the same time help those who desire to obtain the best seed for their respective localities. Prior to January 3, 1914, there were listed with the Agronomy Department over 43,000 bushels of seed corn, some of which has now been sold. All of this is Kansas-grown corn, and as all parts of the corn-growing section of the state are represented the list offers a good opportunity to locate seed corn adapted to all sections of the state. Farmers who have a surplus of seed corn and wish assistance in disposing of it should notify the Agronomy Department at once, giving the name of the variety, amount, and price per bushel, and send at the same time a small representative sample for inspection and germination test. Farmers who wish to secure seed should write the Agronomy Department and secure a list of farmers having seed corn for sale. In this way farmers desiring seed can secure it from other farmers having seed for sale.

WHERE TO OBTAIN SEED.

In many localities it may be impossible to obtain home-grown seed. In this case seed should be obtained that was grown as near home as possible. Where corn must be obtained from distances of one hundred miles or more, the locality from which it had best be obtained will vary with the portion of the state in which it is to be planted.

In northeastern Kansas there is sufficient home-grown corn of the 1912 and the 1913 crops to more than supply the local demand, and in this part of the state it is not necessary to import seed from other sources.

In southeastern Kansas the situation is not so fortunate, since both the 1912 and the 1913 crops were short. In a few favored localities of this part of the state fairly good seed corn was produced in 1913. This and the 1912 corn should be the first choice of seed. The next best source is seed corn from Missouri that was grown directly east of the locality in which it is to be planted.

In north-central Kansas, especially in Smith, Jewell, Republic and a few adjoining counties, there is sufficient old corn to more than supply the local demand and this should be obtained for seed if possible. If home-grown seed is not available, corn from east-central and eastern Nebraska should be secured.

The same thing applies to central and southeastern Kansas with the exception that corn from northeast Kansas is to be preferred to that from more distant sources to the northeast.

For south-central Kansas, early varieties from central and eastern Oklahoma will be better than those obtained several hundred miles north and east. In bringing corn north there is danger of obtaining varieties that will not mature, and care should be taken that suitable varieties are secured.

For the western one-third of the state, corn from central and southern Nebraska and southern Dakota is perhaps the best source of seed, in that the varieties obtained will mature under western Kansas conditions. There is danger in obtaining northern grown seed for any locality in Kansas that the varieties obtained will mature too early to take advantage of the longer growing season and are, therefore, not capable of producing maximum yields.

AVOID PLANTING MIXED CORN SHIPPED IN FOR FEEDING PURPOSES.

A large quantity of shelled corn is being shipped into Kansas this winter for feeding purposes. As a rule, it is a mixed lot from unknown sources. Many farmers will be tempted to use this corn for planting rather than to obtain good seed of varieties known to be adapted to their conditions. No one can afford to take this risk. The risk involved is far too great and more than offsets the trouble and expense of obtaining good seed. This corn may be a poor variety unsuited to Kansas conditions and the vitality of the corn is likely to be low. Such corn should not be planted until every possible effort has been made to obtain better seed.

GERMINATION TESTS.

Corn used for seed next year should be tested for germination regardless of the source of the seed. If it does not germinate ninety per cent or better, it is unfit for seed. No farmer can afford to plant corn a large portion of which will not grow. A little time and effort spent in making a germination test will often save replanting a field or a reduced yield due to poor seed.

KANSAS STATE PRINTING OFFICE.
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TOPEKA, 1914.
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Kansas State Agricultural College.

EXPERIMENT STATION—Circular No. 32.

DEPARTMENT OF ENTOMOLOGY.

GEO. A. DEAN, Entomologist in Charge.

BURN THE CHINCH BUG IN WINTER QUARTERS.

By GEO. A. DEAN and J. W. MCCOLLOCH.

SUMMARY.

1. During the spring and summer of 1913 it cost the farmers of the entire eastern half of Kansas an enormous sum in the aggregate to feed the chinch bugs.

2. Wherever the bugs have done serious damage, 98 per cent of them will be found in the fall in the bunch grass and bluestem in meadows, pastures, ravines, and along roadsides—BURN THESE PLACES.

3. After four years of careful experiments it has been found that November and early December is the best time to burn the winter quarters of the chinch bug.

4. Careful experiments show that fire supplemented by winter kills 985 out of every 1000 bugs.

5. The experiments show that the mortality of bugs from late winter and spring burning is much less than that from fall burning. See tables showing the relative difference between fall and late winter burning.

6. By actual counts and careful estimates it has been found that a roadside one-half mile long covered with bunch grass and bluestem harbored 3,520,000 bugs. Fall burning means the destruction of 3,484,800 of them.

7. Burning does not materially injure meadows or pastures.

8. To be most effective and to get the best results, co-operative fall burning is necessary.

9. It is, therefore, imperative for the farmer to find out whether his grasses are harboring a dangerous number of bugs, and if they are found to do so, he should burn all of the bug-infested grasses without delay and get his neighbors to follow his example.

10. The destruction of chinch-bug cover in a badly infested area of seventeen and one-half square miles during November and December of 1910 gave good results in crops the following summer, effecting in the seventeen and one-half square miles a saving of $7000 on wheat alone, and freeing corn from the usual harvest-time injury.

11. Neglect to destroy these bugs, and with winter, spring and summer favorable to them, wheat, corn, cane and kafir will suffer most severely next year.

BURN THE CHINCH BUG IN WINTER QUARTERS.

WHERE THEY ARE.

In fifty-eight counties of Kansas, representing more than the entire eastern half of the state, the farmers have suffered in the aggregate an enormous loss from the ravages of the chinch bug. In the regions in which during the spring and summer the bugs did noticeable damage, the chinch bugs will be found in the fall congregated in the bunch grasses, which grow along the roadsides, in the meadows, pastures, ravines and waste places. While the large majority of these bugs will go into winter quarters in clump-forming grasses and bluestem growing along roadsides and fences, in pastures and meadows adjacent to infested corn, sorghum, Kafir, milo, etc., in some cases several may be found hibernating in bunches of grass removed by considerable distances from the infested fields. It is, therefore, imperative for the farmer to find out whether his grasses are harboring a dangerous number of bugs. This can be determined by parting the bunch grass and carefully examining the mulch of soil and decayed grass which usually gathers at the base of the stems. (Fig. 1.)

HOW TO KILL THEM.

Experiments covering four years show conclusively that the late fall and early winter is the time to fight the chinch bug. At this season, or during November and early December, they are congregated in the grasses which grow along the roadsides and fences, in pastures, meadows, ravines and waste places, and since it is an easy matter for each farmer to burn these off, it should be done just as soon as conditions will permit of good burning. In the greater part of the infested area this year the per cent of grass land on the farm is small, and every farmer can clean up his place in a day's time, and the cost is practically nothing. (Fig. 2.)

The great advantage of early winter burning is that the farmer protects both his wheat and corn. Late fall and early winter destruction has been thoroughly demonstrated and found successful where it has been coöperatively carried on over areas three miles square or more. In fact, the only essentials to make burning successful are coöperation and thorough work; that is, firing the infested clumps in such a manner as to make them burn close to the crown. (Figs. 3 and 4.) The only places that need to be burned over are those which contain growth of clump-forming grasses. Although a few bugs are found behind the corn blades and in the trash in a stubble field, cornstalk and wheat-stubble land do not need to be burned over, for the few bugs that are there will die before spring.

COÖPERATION FOR THOROUGH AND SYSTEMATIC BURNING.

Inasmuch as coöperative and thorough work are very essential in order to make the burning successful, every county infested with the chinch bugs should organize for a complete destruction of the winter quarters of the chinch bug. If the organization is made a county affair, supported and encouraged not only by the county commissioners and the other county officers, but by every township official, the result naturally will be far more effective than if the work is taken up only locally. Every local organization, such as the Farmers' Grange, the Farmers' Institute, the Farmers' Union, the Anti-Horse Thief Association, etc., should lend its support and help in making the work effective. The several county and district farm demonstration agents, the extension department men, and the field agents of the Kansas State Agricultural College will help in every possible way in organizing for the work.

The department of entomology through its field agents, together with the county and district demonstration agents, will keep in close touch with the chinch-bug situation, and just as soon as the bugs are in their winter quarters and the proper time has arrived for effective burning, will notify the proper officials of the various organizations and will assist in every possible way to get the work done at the right time.

RECORD OF AVERAGE WINTER MORTALITY IN DIFFERENT TYPES OF COVER.

Type of Cover.	*Bugs that perished.*
Bunch Grass.—As many as 3000 to 5000 bugs per clump, with an average of about 1000	15-40
Big Bluestem.—About one-half as many bugs as in the bunch grass,	15-40
Corn Husks and Stalks.—Very few bugs	90-100
Dry Pieces of Manure.—Three to fifty bugs per piece	95-98
Osage Orange.—Few bugs	95-99
Osage Orange Tree Bark.—Few bugs	90-100
Rubbish, Leaves, etc.—Few bugs	90-100
Turnips.—Five to fifty bugs in each plant	90-100

TABLES SHOWING MORTALITY OF BUGS IN BURNED AND UNBURNED GRASS IN DIFFERENT LOCALITIES.

ELLIS COUNTY (1910–1911).

Clump No.	Diameter of clump.	Date of burning.	Degree of burning.	Date of count.	Total number bugs.	Number dead.	P ce de
1....	5 in...	11–19–10.........	About 2½ in. from crown.	2–14–11	18	10	5
2....	3½ in...	do.	2 in. from crown..........	do.	22	20	9
3....	4 in...	do.	2 in. do.	do.	117	117	10
4....	4½ in...	do.	¾ in. do.	do.	10	10	10
5....	5 in...	do.	1 in. do.	do.	7	6	8
6....	3½ in...	do.	1 in. do.	do.	29	29	10
7....	8 in...	do.	1 in. do.	do.	16	15	9
8....	4 in...	do.	2 in. do.	do.	30	30	10
9....	5½ in...	do.	1¼ in. do.	do.	27	25	9
10....	4 in...	do.	1 in. do.	do.	18	17	9
11....	7½ in...	do.	2 in. do.	do.	7	7	10
12....	4½ in...	Not burned	....	do.	56	21	3
13....	3 in...	do.	....	do.	87	35	4
14....	3½ in...	do.	....	do.	57	32	5
15....	3¼ in...	do.	....	do.	39	0	
16....	4½ in...	do.	....	do.	767	330	4

SUMNER COUNTY (1910–1911).

Clump No.	Diameter of clump.	Date of burning.	Degree of burning.	Date of count.	Total number bugs.	Number dead.	Pe cen dea
1....	2½ in..	11–15–10.........	½ in. from crown.	2–19–11	183	183	100
2....	2½ in..	11–15–10.........	1 to 1¼ in. do.	do.	83	80	96
3....	2¾ in..	11–10–10.........	1½ in. do.	do.	25	25	100
4....	2½ in..	12–10–10.........	1 in. do.	do.	109	101	92
5....	4½ in..	12–10–10.........	3 to 4 in. do.	do.	898	735	81
6....	3 in..	11– 9–10.........	1 in. do.	do.	281	249	88
7....	3 in..	12– 1–10.........	1 in. do.	3–14–11	39	37	94
8....	3½ in..	12– 1–10.........	1 to 1¾ in. do.	do.	47	47	100
9....	4 to 5 in.	12– 8–10.........	2 to 2¼ in. do.	do.	57	57	100
10....	4½ in..	12– 8–10.........	1½ to 2 in. do.	do.	83	72	86
11....	3 in..	11– 9–10.........	½ to ¾ in. do.	do.	53	52	98
12....	3 in..	11–15–10.........	¾ to 1 in. do.	do.	99	92	93
13....	4½ in..	Spring burning..	1½ to 1¾ in. do.	do.	835	483	57
14....	4 in..	do. do. ..	1 to 1½ in. do.	3–31–11	114	86	75
15....	6 in..	do. do. ..	1½ to 2 in. do.	do.	345	249	72
16....	3 in..	do. do. ..	2 to 2¼ in. do.	do.	67	50	74
17....	4½ in..	Not burned......	....	2– 9–11	1,059	354	33
18....	4½ in..	do.	....	do.	3,111	1,560	50
19....	5 in..	do.	....	3–14–11	264	67	25
20....	5 in..	do.	....	3–31–11	213	116	36

CHEROKEE COUNTY (1912-1913).

mp o.	Kind of grass.	Size of clump.	Date of burning.	Date of count.	Total number bugs.	Number dead bugs.	Per cent dead.
...	Bunch grass..	Medium...........	12-12-12*.........	3-12-13	77	34	44.1
...	Sedge........	do.	do. *.........	do.	1,557	1,374	88.2
...	Bunch grass..	do.	do. *.........	do.	351	207	59.0
...	do. ..	do.	do. *.........	do.	185	58	31.3
...	do. ..	Small.............	About March 1....	do.	759	216	28.4
...	do. ..	Medium...........	do.	do.	412	181	43 9
...	do. ..	do.	Not burned........	do.	48	4	8.3
...	do. ..	do.	do.	do.	154	6	3.9
...	do. ..	Large.............	do.	do.	1,863	12	.6
...	do. ..	do.	do.	do.	2,118	106	5.0

*Burned a few days after a snow.

RILEY COUNTY (1912-1913).

mp No.	Size of clump.	Date of burning.	Date of count.	Total number bugs.	Number dead bugs.	Per cent dead.
....	6 in. by 4 in.........	12-4-12.......	3-17-13.......	534	426	79.7
....	4 in. by 3 in.........	do.	do.	1,519	1,473	96.9
....	4 in. by 3 in.........	do.	do.	790	770	97.4
....	5½ in. by 4 in.........	do.	do.	1,171	1,139	97.2
....	5 in. by 3 in.........	do.	do.	264	183	69 3
....	5 in. by 3 in.........	do.	do.	84	49	58 3

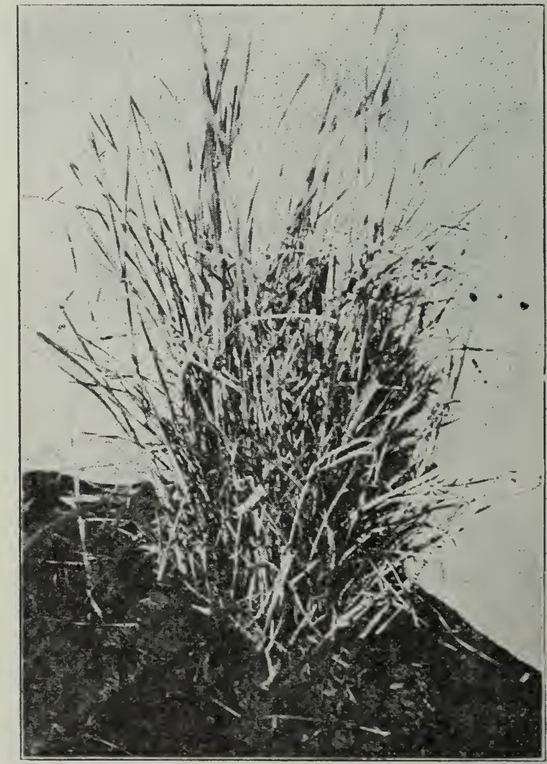
TABLE SHOWING RELATIVE DIFFERENCE IN THE MORTALITY OF BUGS OF FALL AND LATE WINTER BURNING OF BLUESTEM AND BUNCH GRASS.

BLUESTEM.

Clump No.	Date of burning.	Date of count.	Total number bugs.	Number dead bugs.	Per cent dead.
1....	Fall, 1911....................	2-14-12	578	448	77.5
2....	do.	do.	339	311	91.7
3....	do.	do.	576	521	90.4
4....	do.	4- 6-12	606	537	88 6
5....	do.	do.	493	470	95 3
	Late winter.				
6....	2-12-12..................	2-14-12	787	118	14 7
7....	do.	do.	715	207	28.9
8....	do.	do.	244	138	56 5
9....	2-17-12.....................	2-19-12	110	68	61 8
10....	Feb., 1912....................	4- 6-12	1,667	896	53.8
11....	do.	do.	1,044	625	59.8

BUNCH GRASS.

Clump No.	Date of burning.	Date of count.	Total number bugs.	Number dead bugs.	Per cent dead.
1....	Fall, 1911	2- 6-12	1,011	988	97.7
2....	do.	do.	1,426	1,412	99.0
3....	do.	do.	502	476	94.8
4....	do.	4- 6-12	810	781	96.4
5....	do.	do.	1,754	1,642	93.6
	Late winter.				
6....	2-12-12	2-14-12	4,008	3,176	79.2
7....	do.	do.	5,231	2,814	53.7
8....	2-17-22	2-19-12	798	474	59.3
9....	Feb., 1912	4- 6-12	2,414	1,293	53.5
10....	do.	do.	1,614	941	58.3



(*After Headlee.*)

FIG. 1.—Bunch grass, the winter home of the chinch bug. Burn it.

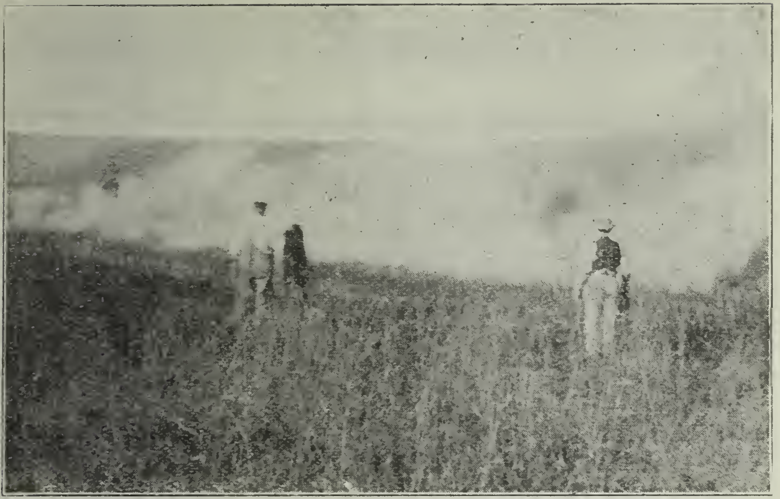


Fig. 2.—What should be done with bug-infested grasses, in waste places, along roadsides and fences, in pastures and mown meadows of native grass. (*After Headlee.*)

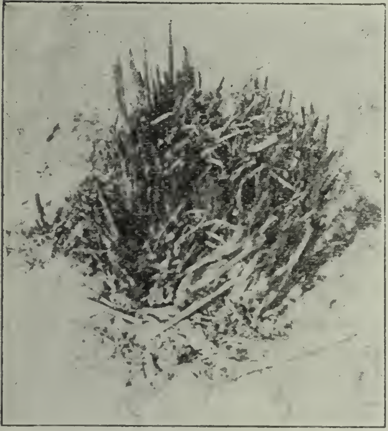


Fig. 3.—The type of burning that kills few bugs—not close enough. (*After Headlee.*)

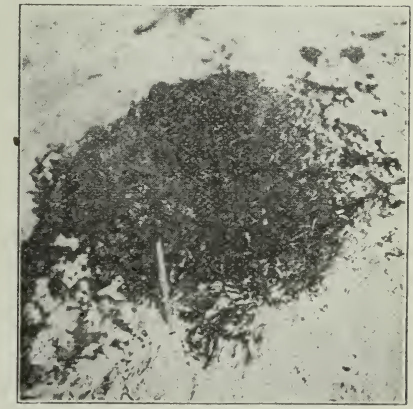


Fig. 4.—The type of burning that kills practically 100 per cent of the bugs. (*After Headlee.*)

Kansas State Agricultural College.

EXPERIMENT STATION.
CIRCULAR NO. 33.

DEPARTMENT OF FORESTRY.
CHARLES A. SCOTT, State Forester in Charge.

THE CHINESE ARBOR VITÆ.

(***Thuya orientalis.***)

By CHARLES A. SCOTT.

THE CHINESE ARBOR VITÆ is an evergreen tree, generally of low, compact growth in its native habitat—the dry, rocky mountains of northern China. When planted in good soil under favorable climatic conditions, the trees attain a height of sixty feet and a trunk diameter of from five to six feet. They reach their best development in a deep, fertile soil, and they resist even a considerable amount of alkali. According to Chinese observations, these trees are known to live to an age of more than two thousand years. The old specimens develop a very characteristic ragged and irregular outline, and are striking objects in the landscape in northern China.

This tree thrives especially in those parts of China where the summers are hot and fairly dry, with an annual rainfall of between fifteen and twenty-five inches, practically all of which falls during the months of July, August, and September. The summer temperature in this region frequently reaches 110 degrees in the shade, while in the mountainous regions, where the tree grows under natural conditions, the winter temperature falls to ten degrees below zero. The Chinese arbor vitæ will withstand a greater degree of cold than this if the winters are dry, but will not endure the cold in moist climates. The soil, moisture and temperature conditions demanded by this tree prevail throughout the western two-thirds of the state of Kansas.

The Chinese arbor vitæ is of recent introduction into the United States. It was introduced into this state probably not over twenty years ago, as the oldest specimens that have been seen are not more than twenty years of age. Wherever the Chinese arbor vitæ has been planted in Kansas it is making a very successful growth, having withstood the climatic conditions of the past eighteen or twenty years without serious injury. It promises to become one of the most desirable trees that has yet been found for western Kansas windbreak and ornamental planting.

METHODS OF PROPAGATION.

The Chinese arbor vitæ is propagated entirely from seed, which is produced in considerable abundance after the trees are from eight to ten years old. The cones are gathered from the trees as soon as they begin to show signs of ripening, which usually occurs during the latter part of September or early in October. These are spread on large sheets or board floors and exposed to the sun until the cones open and liberate the seeds. The seeds and cones are then separated by screening. The seeds may be stored over winter in any dry room, if protected from mice. They are sown in well-prepared beds, either in rows or broadcast, the following April or early May. The seed beds must be given part shade, which is usually accomplished by using a lath or brush screen.

At the age of one year they are ready to be set out in the nursery row, where they are grown for one or two years until ready for permanent planting. The growing of evergreen seedlings, however, requires expert knowledge of nursery work, and it is usually much cheaper to buy the nursery stock than to attempt to grow the seedlings on the farm. The most desirable stock for extensive planting consists of twelve- to eighteen-inch once transplanted trees. The Chinese arbor vitæ is perhaps the easiest of all conifers to propagate. It transplants with very little loss, which feature is sufficient in itself to insure the extensive use of this tree.

ECONOMIC USES.

Because of its extreme hardiness and the ease with which it can be transplanted, the Chinese arbor vitæ should in the future be the most commonly planted windbreak and ornamental tree in western Kansas. The wood is durable and entirely satisfactory and serviceable for fence posts. The greatest worth of the tree, however, will be in its live state for protection and ornamentation. The rate of growth of the Chinese arbor vitæ is faster than that of any other of the evergreens. The one-year-old seedlings range from three to six inches in height, and the rate of growth from this time on varies with the conditions under which the trees are growing. Under favorable conditions they will make a height growth of from fifteen inches to three feet a year.

Under favorable soil conditions in western Kansas, the Chinese arbor vitæ should attain a height of from thirty to forty feet and a stump diameter of from twelve to eighteen inches.

There are two distinct forms of this species. One is a dwarf type that grows very compact and symmetrical. This form is prized highly for ornamental planting. The other form grows erect, with ascending limbs, and on account of its greater height is the more desirable of the two for windbreak planting. The two types are readily distinguishable in the nursery when the trees are two or three years old.

For windbreak or other protection planting, the Chinese arbor vitæ should be planted six or eight feet apart, in rows from eight to ten feet apart. Three rows will make a very efficient windbreak in from eight to twelve years.

In general appearance the tree is very much like the American arbor vitæ. The leaves are scale-like, closely appressed, and throughout the summer deep green, changing with the approach of winter to a rusty brown. The trees retain their leaves for several years, and on account of their compact form are excellent for windbreak purposes.

The Chinese arbor vitæ is found growing with equal success both on very light sandy soils and on heavy clay soils. The fact that it will grow on soils that are strongly alkali gives it a distinct advantage over many other species for prairie planting.

NOTE.—Those who are interested in securing stock to plant might do well to communicate with the State Forester, at the Kansas State Agricultural College, Manhattan, Kan.

Chinese arbor vitæ in the state nursery. Two years of age and once transplanted

A Chinese arbor vitæ eight years of age.
A very good form for an ornamental tree

A windbreak of 18-year-old Chinese arbor vitæ.
These trees average about 20 feet in height and 8 inches in diameter at the stump.

Kansas State Agricultural College.

EXPERIMENT STATION.
CIRCULAR NO. 34.

DEPARTMENT OF AGRONOMY.
L. E. CALL, Agronomist in Charge.

SWEET CLOVER.

By C. C. CUNNINGHAM.

SWEET CLOVER is destined to occupy an important place on the farms in many parts of Kansas, especially the southeastern and the western parts of the state. As a soil improver it is unexcelled; for pasturing purposes it has considerable value; and as a forage crop it can be utilized to good advantage where alfalfa or red clover can not be successfully grown.

There are several varieties of sweet clover, of which the common white sweet clover and the large biennial yellow sweet clover are the most important. The white variety is generally to be preferred for farm purposes, although the biennial yellow is sometimes preferred where hay production is desired.

Practically all of the soils in the state are adapted to growing sweet clover; poorly drained, acid, and very sandy soils excepted. It thrives best on fertile land well supplied with lime, but will make a satisfactory growth on very poor soils. When grown for hay it is best to plant on fairly fertile land. Where the sweet clover is to be pastured it may be planted on the poorer soils and yet yield returns that will justify the growing of this crop upon them. It is not to be expected that sweet clover will make as great a growth on very sandy soils as on more fertile land. However, there are many places in western Kansas where sweet clover is bringing larger returns from sandy soils than any other crop that can be grown.

PREPARING THE SEED BED.

To seed sweet clover successfully a thoroughly compacted seed bed is necessary, with just enough loose soil on top to enable the seed to be covered. The lack of a solid seed bed is probably the chief reason why sweet clover so often fails when seeded upon cultivated fields. Sweet clover has been seeded successfully in western Kansas by broadcasting it on sod land and stirring the top soil lightly with a disk harrow, to insure the covering of the seed. Under natural conditions it reseeds itself readily on the hard compact soils along roadways, in prairie sod, and vacant lots where the seed is scattered by natural agencies, such as rain and the alternate freezing and thawing of the ground. Evidently there is greater danger of having the seed bed too loose than too firm when seeding sweet clover on cultivated land. If it is necessary to plow the ground in preparing it for sweet clover the plowing should be done several months before seeding. It is usually best to seed on corn ground or after some other inter-tilled crop and depend upon implements that merely stir the surface of the soil to prepare the seed bed.

SEEDING SWEET CLOVER.

Under natural conditions sweet clover remains in the ground during the winter and germinates in the spring, although occasionally a few seedlings may be found in the fall. It may be seeded any time from January to the last of May, with equal chances of success. In the eastern fourth of the state it may often be successfully seeded with a nurse crop of oats or barley, provided the seed bed is not too loose and open and a rather thin stand of grain is grown. In favorable seasons good stands of sweet clover may be obtained by seeding with fall wheat, the sweet clover being sown in the spring in the same manner as red clover is usually seeded. As a rule about twenty to twenty-five pounds of clean or hulled seed per acre is required. Where the unhulled seed is used the amount of seed per acre should be increased five pounds. This comparatively large amount of seed is necessary because of the fact that often only about one-half of the seed germinates the first season. The remainder of the seed has such hard seed coats that it does not germinate the first season, and, therefore, is practically useless.

Rough, wooded, or stony lands that are untillable may be seeded by sowing the sweet clover broadcast during the late fall or winter. The seed will be worked into the ground by the alternate freezing and thawing of the ground or washed under by rains. In very sandy soils sweet clover is often drilled into the thin native sod by using a disk drill, as any other preparation of the ground would make the seed bed too loose.

INOCULATING.

To produce satisfactory results it is necessary that sweet clover be inoculated with the proper bacteria. If it is not growing along roadsides and in fence corners or anywhere else in the locality in which it is to be seeded, it is very likely that inoculating will be essential. This may be done by obtaining soil from an alfalfa field or ground on which sweet clover is growing and spreading it over the field which is to be seeded, at the rate of two hundred to three hundred pounds of infected soil to the acre. This inoculated soil should be harrowed in immediately, as exposure to the sunshine and the drying out of the soil will kill the bacteria. Best results may be obtained by applying the soil on a cloudy day. If inoculated soil is not available within reasonable distances it may be more practical to inoculate with the pure cultures that are sold for this purpose. This method consists of treating the seed with a pure culture of the proper kind of bacteria, according to directions accompanying the material. The inoculated seed should be sown soon after it is treated, and should never be exposed to the sun.

Fortunately the only portion of Kansas where it would be necessary to inoculate for sweet clover is in those parts of the eastern fourth of the state where the crop is not growing naturally. The soil in the remainder of the state is evidently well supplied with the proper kind of bacteria.

HANDLING SWEET CLOVER FOR HAY.

Sweet clover properly handled produces a fair quality of hay which makes a desirable substitute for the more valuable forms, such as alfalfa or red clover. One cutting of sweet clover can be obtained the first year. This crop should not be cut until the crown sprouts have begun to show on top of the roots about one inch underground. At this time the crop can be cut close to the ground. Two and perhaps three crops of hay may be obtained the second year. The first one should be cut just before the first bloom buds appear, since the plants rapidly become coarse and woody after they start to bloom. The sweet clover should be cut sufficiently high to leave a few branches and leaves on each plant. If cut too close at this time many of the plants will be killed. The second cutting should be handled in the same way as the first. The time of cutting will have to be governed by the judgment of the farmer. The sweet clover will be continually in bloom soon after the second cutting comes on. Ordinarily it should be cut when about twenty inches high, and must be cut high, as at the first cutting. The third cutting may be mown close to the ground. The hay is cured in the same manner as alfalfa or red clover.

SAVING THE SEED.

Where a seed crop is desired the second cutting of the second year's growth is the most practical one to leave, although maximum yields of seed can be obtained where the first cutting is allowed to grow to maturity. The sweet clover may be harvested readily with a binder, binding and shocking it like a small-grain crop, or by cutting with a mower and raking and stacking similar to the way alfalfa grown for seed is handled. Along the Arkansas river in western Kansas it is a common practice to head the sweet clover with an ordinary grain header. It is then shocked in medium size shocks, usually placing one header-box load in each shock. This allows it to cure out readily and yet permits it to be stacked in a small space so that it can be brought rapidly to the thresher. It should be cut about the time three-fourths of the seed pods become dark. Avoid handling the straw when in a very dry, brittle condition, as the seed will shatter badly at such times. The sweet clover should not be hulled or threshed until it is thoroughly dry. Yields of from two to eight bushels per acre may be expected.

SWEET CLOVER AS A PASTURE CROP.

Sweet clover makes excellent pasture for cattle, sheep, horses and hogs. It very rarely causes bloat, and for this reason is preferable to alfalfa for pasturing cattle.

Sweet clover is practically equal to alfalfa and red clover in feeding value, and stock pastured on it make gains that compare favorably with those secured on the latter crops. For pasturing purposes sweet clover is of greatest value in supplementing other pasture. It produces early and late grazing, survives the midsummer droughts, often furnishing succulent pasture during the time pasture grasses are dormant, and will produce fairly well on soils that would otherwise be practically barren. Sweet clover may be grown along river bottoms, on land where the water does not stand, even though the water table occasionally rises within two feet of the surface of the soil. Because of this fact it is an important pasture crop on the low river bottoms.

As a rule live stock have to acquire a taste for sweet clover before they can be induced to eat it. The best way to accustom them to the crop is to pasture them upon it early in the spring, before other forms of green feed are available.

For best results the sweet clover should be pastured heavily enough to keep down the growth, so that at all times there will be an abundance of fresh shoots for grazing purposes. It may be necessary to clip back the old growth once during the second season to maintain the development of fresh shoots. A sufficient number of plants should be left to thoroughly reseed the field, in case permanent pasture is desired. If hogs are pastured on the sweet clover during the first year it is best to ring them to prevent them from digging up the roots of the young plants.

SWEET CLOVER AS A SOIL IMPROVER.

For quick results in improving the soil sweet clover is superior to most other crops. Its ability to thrive well on soils lacking in humus or otherwise badly run down makes it especially adapted for this purpose. Like alfalfa, cowpeas and other legumes, it has the ability to obtain nitrogen from the air by means of the nitrogen-gathering bacteria which live in tubercles on the roots of the plants, thus adding much nitrogen to the soil in which it grows. When plowed under for green manure or allowed to remain on the land this crop is a very efficient one in building up the humus content of the soil. The large roots, which penetrate deeply, break up the lower layers of the soil and add much humus thereto when they decay, thus improving the physical condition of the soil to a considerable depth below the depth of plowing. Sandy as well as heavy clay and hardpan soils, which would not otherwise produce satisfactory crops, may be so improved in texture by growing sweet clover for a few years that they become quite productive.

Kansas State Agricultural College.

AGRICULTURAL EXPERIMENT STATION.

CIRCULAR NO. 35.

DEPARTMENT OF DAIRY HUSBANDRY.

O. E. REED,
Dairy Husbandman.

REPORT OF

THE DICKINSON COUNTY COW-TESTING ASSOCIATION.

RESULTS OF THE FIRST YEAR.

One hundred and thirty-four cows in the Association have complete records for twelve months. These made an average production of 6019 pounds of milk and 246 pounds of butter fat. The average Kansas cow produces 100 pounds of butter fat a year. These figures show that the cows tested are very much better than the average cow of the state.

The average cost of the feed per cow, per year, was $35.59. The value of the butter fat produced was $90.48, leaving a net profit per cow of $54.89. The calf and the manure are a liberal offset to the labor and risk.

1 cow produced 546.3 pounds of butter fat during the year.
1 cow produced 448.5 pounds of butter fat during the year.
14 cows produced between 350 and 400 pounds of butter fat.
25 cows produced between 300 and 350 pounds of butter fat.
37 cows produced between 250 and 300 pounds of butter fat.

The following table gives the yearly record of the best and poorest cow in each herd. All of the cows did not milk 12 months, but the feed record is complete for the year.

TABLE I. RECORDS OF BEST AND POOREST COWS IN EACH HERD.

	Months milked.	Pounds of milk.	Pounds of butter fat.	Cost of feed.
Herd No. 1:				
Best	11	7,926	372	$37.17
Poorest	7	2,784	125	35.47
Herd No. 2:				
Best	9	6,990	274	35.03
Poorest	5	1,418	59	33.23
Herd No. 3:				
Best	12	6,750	353	37.59
Poorest	8	4,530	213	34.59
Herd No. 4, 9 months' record:				
Best	9	7,182	282	31.70
Poorest	6	2,733	108	28.76
Herd No. 5:				
Best	11	8,556	317	34.23
Poorest	10	3,405	121	30.15
Herd No. 6:				
Best	10	6,510	258	27.13
Poorest	7	1,260	66	25.11
Herd No. 7:				
Best	10	8,191	377	26.16
Poorest	7	3,801	138	22.14
Herd No. 8:				
Best	8	6,087	265	21.55
Poorest	12	3,534	148	22.32
Herd No. 9, 8 months' record:				
Best	7	3,432	137	8.70
Poorest	2	609	23	10.45
Herd No. 10:				
Best	11	5,808	262	33.10
Poorest	10	4,167	164	28.58
Herd No. 11:				
Best	12	6,821	284	28.80
Poorest	11	4,416	194	27.49
Herd No. 12, 6 months' record:				
Best	6	3,579	119	8.56
Poorest	6	1,302	70	8.56
Herd No. 13:				
Best	12	11,460	362	44.74
Poorest	8	6,852	255	41.03
Herd No. 14:				
Best	11	13,698	546	55.91
Poorest	11	4,827	175	43.40
Herd No. 15:				
Best	11	7,839	347	31.10
Poorest	10	4,058	154	31.46
Herd No. 16:				
Best	11	7,290	376	49.89
Poorest	9	6,465	203	38.70
Herd No. 17:				
Best	12	8,094	449	49.00
Poorest	10	6,318	328	45.93
Herd No. 18:				
Best	11	3,863	238	43.42
Poorest	8	2,409	159	42.38
Herd No. 19:				
Best	12	7,794	286	42.82
Poorest	12	6,399	209	42.82

The figures show conclusively that all of the good cows were not owned in one herd, but there were some poor ones in the same stable with the best ones. It is interesting to note the production of the best and the poorest cow in each herd and compare the cost of production. The best cow, a grade Holstein, was found in herd No. 14. She produced 546 pounds of butter fat in 11 months. The poorest in this same herd produced only 174.78 pounds of fat. The best cow in the association produced 546 pounds of fat at a cost of $55.91, while the poorest produced only 59 pounds of butter fat at a cost of $33.23. Which is the more profitable?

Three of the herds in the association had been graded up for a number of years before the association was organized; therefore the variation between the poorest and the best is not so great as in some of the herds where no attempt had been made to weed out the poorest cows.

In herds Nos. 9 and 12 the feed of the poorest cows amounts to more than that of the best cows. This is explained by the fact that the best cow was giving milk only while on pasture. The poor cow was fed extra during the first month she was milked, but later had same pasture as best one received.

THE BEST AND THE POOREST COWS IN THE ASSOCIATION COMPARED.

Tables II and III show records of the ten best and ten poorest cows in the association.

Table II. RECORDS OF THE TEN BEST COWS.

Months milked.	Milk.	Fat.	Value of products.*	Cost of feed.	Profit.
11	13,689	546	$201.12	$55.91	$145.21
12	8,094	449	152.58	49.00	103.58
11	10,258	386	144.44	50.35	94.09
11	7,229	384	131.90	48.49	83.41
10	8,191	377	133.92	26.16	107.76
11	7,290	376	130.00	49.89	80.11
9	8,042	375	131.77	37.42	94.35
11	7,926	372	131.50	37.17	94.33
10	6,573	368	124.86	41.30	83.56
10	6,973	365	125.70	47.77	77.93
Average	8,427	400	$140.78	$44.35	$96.43

* Butter fat valued at 28 cents per pound and skim milk at 40 cents per hundred.

Table III. RECORDS OF TEN POOREST COWS.

Months milked.	Milk.	Fat.	Value of products.	Cost of feed.	Profit.	Loss.
5	1,418	59	$21.58	$33.23	......	$11.65
7	1,260	66	22.83	25.11	......	2.28
7	2,796	117	42.49	27.35	$15.14	......
10	3,405	121	46.16	30.15	16.01	......
9	3,102	125	45.89	26.63	19.26	......
7	2,784	125	44.62	35.47	9.15	......
7	3,801	138	52.25	22.14	30.11	......
8	3,222	142	50.95	27.25	23.70	......
8	4,102	149	56.04	34.73	21.31	......
12	3,534	148	53.92	22.32	31.60	......
Average	2,942	119	$43.67	$28.44	$15.23	......

The ten best cows made an average profit of $96.43, which is more than six times the average profit made by the ten poorest. With one exception, the ten best cows were dairy-bred animals, while there was only one of the ten poorest that showed any trace of dairy blood. Of forty-one cows that made over 300 pounds of butter fat during the year there were only three scrub cows or cows that did not show dairy blood.

The figures show that the ten poorest cows made an average of only 119 pounds of butter fat for the year, at a profit of $15.24. However, it should be borne in mind that the prices used in calculating the cost of feeds were farm values, and the majority of the poor cows calved in the spring and produced milk only while on grass, thus greatly cheapening their ration.

Cow No. 1.—Yearly record: Milk 13,698 pounds, butter fat 546 pounds; cost of feed, $55.91. This grade Holstein made the best record for the year. She shows dairy type and is a persistent milker.

The calf and the manure usually pay for labor, but if the labor of milking were charged up to all the cows the ten poorest would show a loss, while the ten best ones would show a nice profit.

A number of cows showing low records of production are really good cows and were retained in the herds. Their records this year were low because they were allowed to remain dry several months. It is generally true that many good cows are allowed to go dry longer than necessary. The cow that gives milk throughout the greater part of the year usually returns the greatest profit.

One of the advantages to be gained from keeping a record of a cow is brought out in the case of the grade Holstein cow that made the best record. She dropped a bull calf early in the year, and it was sold to a neighbor for $5. The cow made an excellent record for the first few months, and the bull calf changed hands at $18. When the yearly record was completed and the cow showed a production of over 540 pounds of butter fat, the calf again changed hands, at $50—a good price for a grade Holstein bull under a year old.

Cow No. 2.—Yearly record: Milk 1418 pounds, butter fat 59 pounds; cost of feed, $33.23. A common cow, with an uncommonly poor record of production. This cow's principal fault is that she goes dry too early. She was dry for seven months during the past year.

CONCLUSIONS.

Although Dickinson county is one of the oldest dairy sections in Kansas, these tests have demonstrated that there are many cows that are being kept at small profit, or even at a loss. The effects of the work of the association will extend over a long period of time. The members who were most interested in building up a herd were the ones who were enthusiastic about continuing the association. Only a few dropped out, and they represented the ones not particularly interested in dairying.

The results of this year's work prove that one can not always pick out the most profitable cows by looking at them, and that the only sure way to select cows and build up a herd is by keeping records on them.

While some members have attempted to keep private records, they all agree that where it is possible the cow-testing association affords the cheapest and most satisfactory method of getting accurate records on the cows. However, it pays to keep private records where it is not possible to be a member of an association.

Cow No. 3.—Yearly record: Milk 7,290 pounds, butter fat 376 pounds; cost of feed, $49.89. A common cow with a good record. She is a persistent milker and was well fed. There are many Kansas cows that can do as well if given the opportunity.

The results obtained in this first association suggest that there should be an organization of this kind in every dairy community. The Agricultural College stands ready to assist any community in establishing cow-testing associations.

A study of the herd books shows that in too many instances the owners allowed cows to go dry several months during the year. Some of the poorest cows naturally go dry soon after freshening, but many good cows also dry up because of carelessness and poor management.

ORGANIZATION.

In November, 1912, the writer and Mr. F. H. Scriber, representing the Dairy Division of the United States Department of Agriculture, assisted by a number of local business men at Abilene, Kan., succeeded in organizing the first cow-testing association in Kansas. The Dickinson County, Kansas, Pioneer Cow-Testing Association for 1913 started with twenty-two members, representing or paying for 379 cows. Some of the members dropped out during the first two or three months on account of selling their herds. Others took their places from time to time. This will account for some herds showing records for only a few months.

Each man was assessed a dollar a cow a year, payable quarterly. No member paid for less than twelve cows. Some herds contained only four to eight cows, but a minimum charge for twelve was necessary in order to secure enough funds in filling up the twenty-six testing days for each month. Two members used more than one day. One man required three days to test cows for the Holstein Advanced Registry. A Jersey breeder used two days in order to have his cows tested for the Register of Merit. These members were charged at the regular rate for the extra days.

The herd books for the Association were furnished free of charge by the Dairy Division, United States Department of Agriculture. The testing outfit and acid were furnished by the business men of Abilene and the Belle Springs Creamery Company.

ADVANTAGES OF AN ASSOCIATION.

The principal advantage of a cow-testing association is in obtaining an exact record for each cow in the herd. A very conservative estimate is that about one-third of the cows in Kansas do not pay for the feed they eat. If a cow does not produce a dollar's worth of milk and butter fat for each dollar's worth of food consumed she is a poor investment. Cows of this sort are worse than boarders, for they eat up the profit made by the good cows. With these facts at hand, it can easily be seen that there is a great opportunity to increase the net profits from the average herd by spotting the poor cows and discarding them from the herd.

Moreover, knowing the record of production of the cows in a herd enables one to feed them more intelligently. It is a common practice to feed all the cows in the herd alike. Under these conditions the poor cow will be fed too much and the good cow will not get enough. The proper way is to feed each cow in proportion to the amount of milk she produces. When this practice is adopted it usually results in a greater production of milk on less feed.

Another advantage the members have is the suggestions and advice from the tester. Very often he can give information in regard to feeding the cows that will prove beneficial.

A record made by a man regularly employed for the purpose has a greater value than a private record when one wants to sell an animal or the offspring of one of the animals in the herd.

If desirable the members will be able to coöperate along other lines, such as buying feed in carload lots, and thereby effect a great saving.

An organization of this kind often leads to community breeding, which means that a part or all of the members decide to handle only one breed of cattle. They can coöperate in buying or selling breeding stock, trade herd sires, and thereby reduce the cost of keeping up a herd. Continuous breeding of a definite breed in a community soon establishes a center for the breed. Buyers will be attracted to this community and all surplus stock can be readily sold.

When one desires to make official tests on the cows in his herd it can be done at less expense through the cow-testing association.

NOTE.—Mr. R. A. Cooley did the testing for the Association for the first three months, and Ralph W. May held this position during the remainder of the year.

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Kansas State Agricultural College.

AGRICULTURAL EXPERIMENT STATION.

CIRCULAR No. 36.

DEPARTMENT OF AGRONOMY.

PREPARATION OF EXHIBITS FOR FAIRS AND CONTESTS.

G. E. THOMPSON.

AN ATTRACTIVE EXHIBIT.

Material prepared for exhibition purposes should be of the current season's growth unless otherwise stated in the exhibition rules. Each sample shown should have a card attached giving the common name of the grain and the state and county in which the exhibit material was grown. Seed exhibited in bags should have cards giving this information placed within as well as without the bags.

GRAIN—WHEAT, RYE, OATS, BARLEY, ETC.

All grain should be true to the variety name under which shown. The samples should be uniform throughout. No sample should consist of less than one peck, and they should be larger if so called for by the local rules. All grain should be well ripened and should have an appearance of strong vitality.

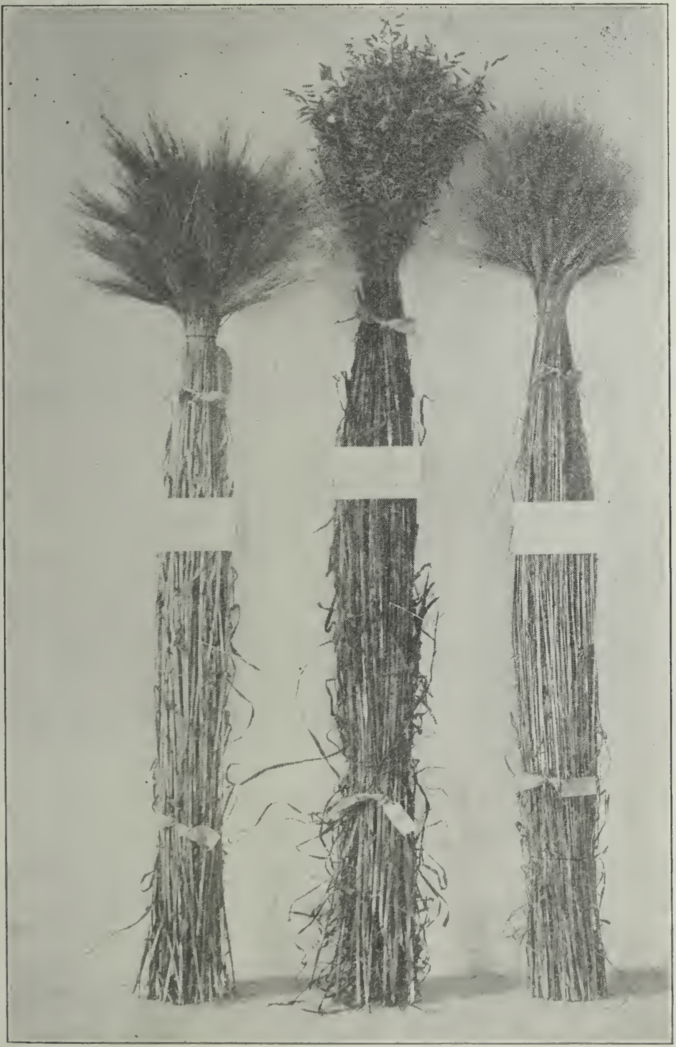
A test of the sample should equal or exceed the legal weight of the grain shown. The sample exhibited should be free from smut or disease of any kind and should not be bleached. All samples should be well graded, that is, contain grains of equal size and of good, uniform, natural color. It should be pure, that is, free from all other grain, weed seeds, chaff, and dirt. Oats should not be clipped. All exhibits should be placed in neat-appearing sacks or containers.

SHEAVES OF GRAIN.

Sheaves of grain shown for exhibition purposes should be true to the variety under which they are exhibited, and uniform throughout. The heads should be well filled, well formed, and no head with shrunken, shriveled or diseased grain should be allowed to enter the sheaf. The straw should be cut close to the ground in order to show full and actual length. Grains to be used in exhibition sheaves should be cut before they are fully mature. Usually they make the best appearance when cut in the hard dough stage. They should be hung head downward and cured in a dark place where there is free circulation of air. The sheaf shown should be four inches in diameter. It is unnecessary to strip leaves from the stems, although if for decorative purposes this may improve the appearance. Bundles should be firmly but not too tightly bound in two to three places, depending on the length of the material. Ribbon or tape one-half inch wide and of suitable color should be used for binding. In wrapping the bundles for carrying or shipping care should be taken that they are so thoroughly protected that the beards will not be broken or the grain shelled. To prevent shelling, the grain should not be too dry, yet dry enough that it will not mold. Each bundle should be wrapped separately in paper, packed perfectly flat and as tight as possible.

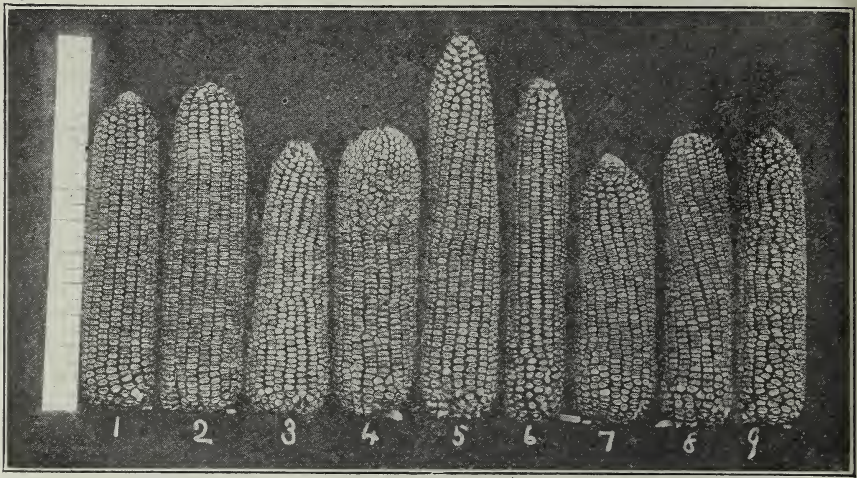
CORN.

Samples of corn should be prepared under two classes: single-ear entries, and ten-ear samples. Before selecting for any variety, secure the standards of perfection for that particular variety and choose ears that conform to this standard. In selecting a ten-ear sample, make certain that it is uniform throughout and that it contains no mixtures. The ears should be of the same length and size, and should be uniform in color and shape of kernel. Each ear in the entire sample should be of strong vitality. Do not select ears from which the kernels of the butts or tips have been shelled. Do not remove kernels from any part of the ear as they may be disqualified by the judge if there are kernels missing. *Do not glue in* missing kernels, weight or plug the pith of the cob, or in any way mutilate the sample, as the judge is allowed to throw out any sample that has the "appearance" of having been "worked."



SMALL GRAINS.—WELL-PREPARED EXHIBITION BUNDLES.

In packing samples of corn for shipment each ear should be wrapped separately in paper, placing excelsior about the butt and tip of each ear. The samples may then be placed in a box, placing excelsior around the entire sample. Great care is required in packing ears for shipment or there will be considerable damage to the butts and tips of the ears.



GOOD AND BAD TYPES OF CORN.

Ears 1 and 2 are good; 3 is too tapering; 4 is reverse tapering; 5 is too long; 6 is too small in circumference; 7 is too short and too large; 8 has curved rows; 9 has crooked and indistinct rows, and kernels of irregular size and shape.

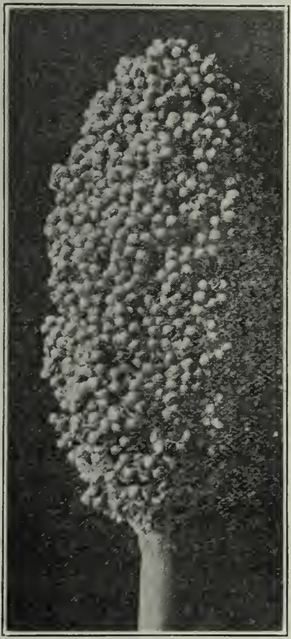
SORGHUMS.

Sorghum heads are usually shown in samples of ten heads for each variety. In selecting sorghum heads make sure that they are true to the variety name under which shown. Select for uniformity and avoid hybrid heads. If the variety is of the grain type, select a head which is compact, well filled from butt to tip, and which does not tend to shatter easily. Select heads which have been well cured but which have not been bleached by weather conditions.

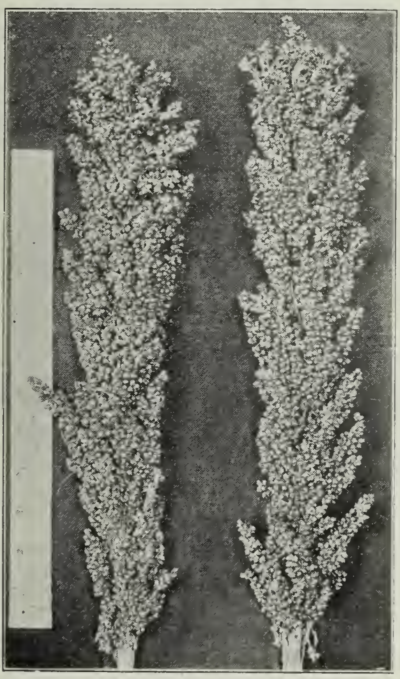
Samples of this kind had best be selected in the fall as soon as they are mature, and hung to cure in a dark, dry place where there is ventilation. In packing for shipment each individual head should be wrapped separately and the sample packed in such a manner that the heads and stems will not be broken during shipment.

SORGHUM BUNDLES FOR FORAGE.

In showing sorghum bundles for exhibition purposes, the bundles should be eight inches in diameter. All stalks should be as leafy as possible for the variety shown. They should be of bright green color, free from leaf spot, rust or molds. No leaves should be stripped from the stalks. The stalks should be cut near the ground in order to show the actual height of the plant. In preparing bundles of this nature the grower should select them at the time which he considers best for cutting for forage purposes. Usually this is in the soft dough stage.

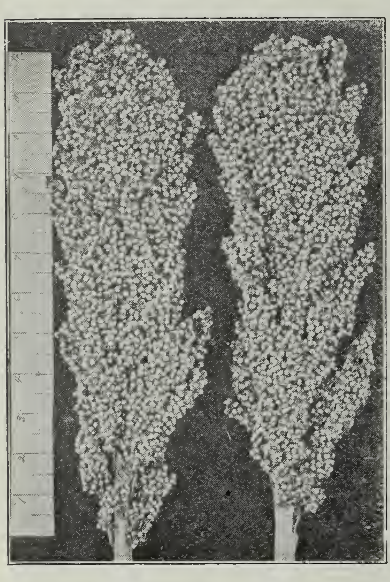


WELL-SHAPED HEAD OF MILO.

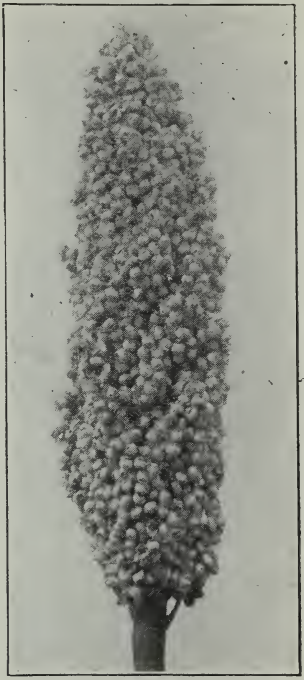


TYPICAL HEADS OF RED KAFIR.

To cure in the best manner they should be cured in a dark room where there is free circulation of air, and hung from the butts of the stalks so that the stalks will dry straight and the leaves will take such a position that they will form a bundle readily without breaking. When it is possible to do so, the bundles can be cured in better condition and make a more attractive exhibition if the floor beneath is covered with saw-dust or some similar material and kept slightly dampened. Before placing on exhibition, bundles should be tightly tied in from three to four places, depending on the height of the variety shown.



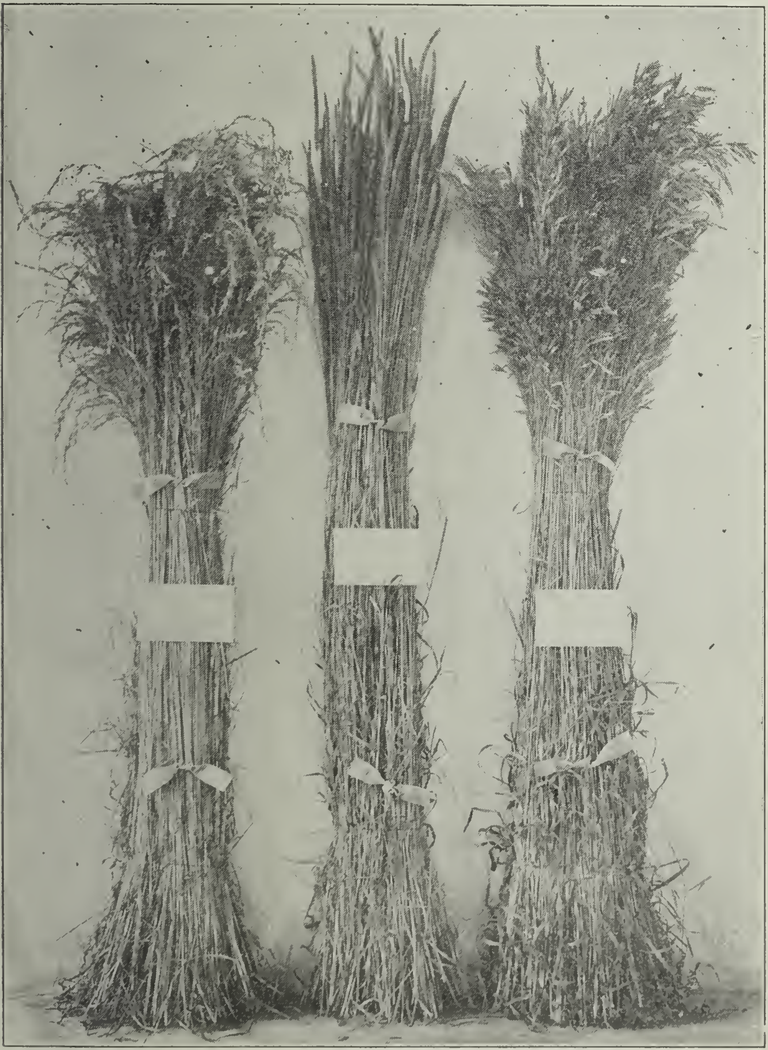
GOOD HEADS OF BLACKHULLED WHITE KAFIR.



TYPICAL HEAD OF FETERITA.

GRASSES AND MILLETS.

All other forage exhibits, such as grasses and millets, should be shown in sheaves not less than four or more than six inches in diameter at the middle band. They should be cut at the time when they are the most desirable for feeding purposes. The materials should be cured after the manner described for curing sorghums, that is, curing in a dark place where there is plenty of ventilation. It may be spread out on a rack or table for drying. If the air in the curing room is kept damp the samples will cure with a more natural green color. No leaves should be stripped from any of the stems. Before placing on exhibition the bundles should be neatly tied with a narrow tape or ribbon, making two or three ties, depending on the length of the material shown. In making up exhibition bundles of grasses, alfalfa, or any forage crop, it is best to show a sample of each cutting obtained during the season, giving the date of cutting. In making up the exhibit for display purposes as well as for prizes, it is always well to secure as many samples as possible of the native grasses in addition to the tame grasses.



EXHIBITION SHEAVES OF GRASSES.
(Note natural appearance.)

KANSAS STATE PRINTING OFFICE.
W. C. Austin, State Printer.
TOPEKA. 1914.
5-2463

Kansas State Agricultural College.

AGRICULTURAL EXPERIMENT STATION.

CIRCULAR NO. 37.

DEPARTMENT OF ENTOMOLOGY.

THE HESSIAN FLY SITUATION IN KANSAS.[1]

GEO. A. DEAN and J. W. MCCOLLOCH.

1. That the Hessian fly is an insect capable of inflicting on Kansas wheat injury amounting to millions of bushels was fully demonstrated in 1908, when forty-one Kansas counties reported injury, ranging from 5 to 50 per cent of the crop, causing a loss of 9,676,000 bushels.

2. The destructiveness of the fly's work to the individual farmer is not measured by its average annual damage, but by the percentage of his crop it may destroy, which may be 100 per cent.

3. The Hessian fly is again increasing and destroying a considerable amount of wheat. In 1912 it was confined principally to the northeastern part of the state, and in 1913 serious damage occurred in this section, especially along the Kaw valley.

4. The dry summer of 1913 did not seriously hinder the development of the fly, and the infestation has now spread over the entire eastern half of the state. The fall, winter and spring conditions were favorable for the fly, and with a continuance of these favorable conditions the infestation is certain to increase.

5. To avoid or prevent serious damage next fall it is imperative for the farmer to keep in close touch with the situation and immediately after harvest put into practice the methods of control which have been found practical and effective.

6. The infestation in the fall wheat comes from two sources —the stubble of the previous crop and volunteer wheat. DISK AND PLOW THEM UNDER.

7. Disk the stubble immediately after harvest. This not only conserves the moisture and makes plowing easier, but also

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[1] The principal facts embodied in this circular are taken from Bulletin No. 188, Kansas Agricultural Experiment Station. Although this bulletin was issued less than a year ago, the demand last fall was so great that the supply is nearly exhausted.

starts the growth of the volunteer wheat and has a tendency to bring about the early emergence of the fly. In many cases the disking pulls out the stubble and exposes the flaxseeds to unusual climatic conditions, which are fatal to many of them.

8. About three or four weeks after disking, the ground should be plowed to a depth of at least six inches and all stubble and volunteer wheat buried under at least three inches of soil. By doing this practically all of the flies will be buried, and it will be impossible for them to reach the surface.

9. Immediately after plowing the ground should be refirmed and worked into a good seed bed. It should also be kept mellow and free from all weeds and volunteer wheat.

10. The Agronomy Department of the Experiment Station has shown conclusively that where the ground is prepared in this manner it not only produces the maximum yields, but the crop may be planted with safety later in the season.

11. DELAY THE PLANTING OF THE CROP UNTIL THE FLY-FREE DATE, which, after seven years of experimental sowings, has been determined according to the accompanying chart.

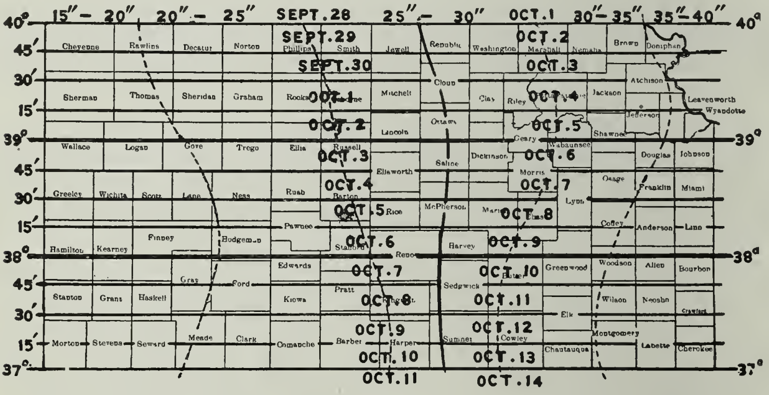

FIG. 1.—Map of Kansas, showing date of safe sowing calculated directly from 1907-'08, 1908-'09, 1909-'10, 1910-'11, 1911-'12, 1912-'13 experimental sowings.

12. In average years, with proper preparation of the seed bed, the date of safe sowing is at least as early as the date on which wheat should be sown to make a maximum yield if no fly were present.

13. For the best results in the control of the Hessian fly all farmers should coöperate and follow the methods of planting as recommended, for the Hessian fly, like most of the farm-crop insects, is most successfully controlled when a concerted fight is made against it.

STAGES OF THE HESSIAN FLY.

The Hessian fly in the course of its development passes through four different stages—adult, egg, maggot, and flax-seed. These stages differ so greatly that one would not suspect any relationship between them. The adult fly is a small, long-legged, dark-colored insect, resembling a mosquito. The tiny reddish eggs are usually deposited in the grooves on the upper surfaces of the leaves. They are so small and inconspicuous as to be barely visible to the naked eye, and resemble wheat rust in its early stages. The maggots are whitish in color and are found between the leaf sheath and the stalk, either at the crown or at one of the joints. The flaxseed, or resting stage, is the one with which many farmers are most acquainted. It is the reddish-brown stage found in the late fall or after harvest just above the crown or at the nodes of the plant. In size, shape and color it has considerable resemblance to a flax seed, and hence the name.

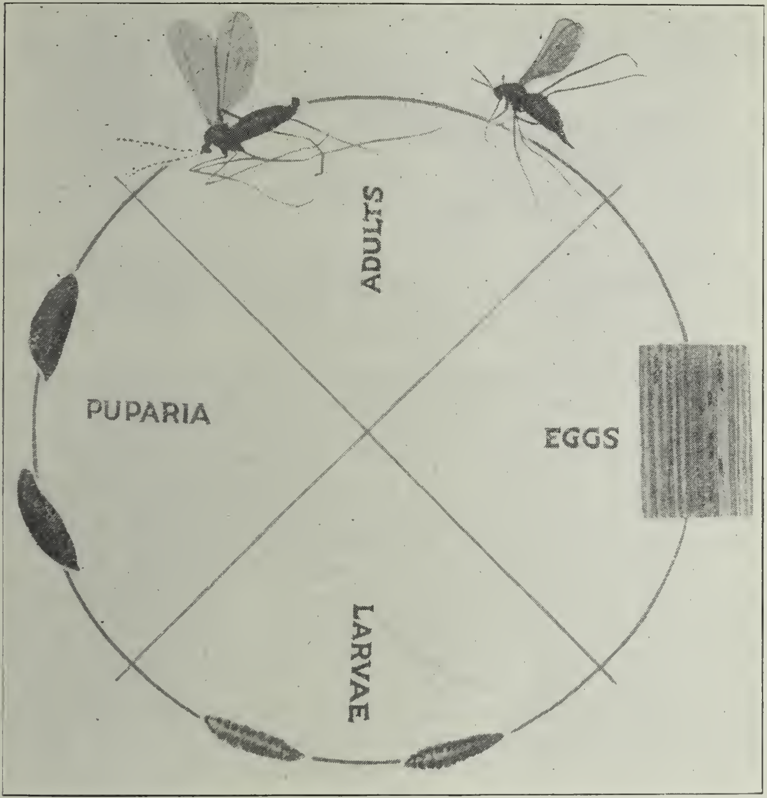

FIG. 2.—Life cycle of the Hessian fly. The one to the right of the adults is the female. Adults five times natural size. Eggs in natural position on wheat blade, five times natural size; larvæ or maggots, three times natural size; puparia or flaxseeds three and one-half times natural size.

LIFE HISTORY.

The life history of the Hessian fly is subject to great variation during the year, but in general it follows a rather definite course. Starting about the first of April, the adult flies begin to emerge from the flaxseeds that have passed the winter in the volunteer and the regular crop of wheat. From this time on until the last of April the adults will continue to emerge. The flies live only a few days, but during that time deposit from one hundred to three hundred of their eggs in the grooves along the upper surface of the wheat leaves. The eggs hatch in from four to eight days, and the young maggots work their way down the leaf to a place between the leaf sheath and the stalk, where the leaf has its origin. Here the maggots feed, grow, reach maturity, and transform to flaxseeds. By the last of May the supplementary spring brood is out, and the life cycle is repeated. After harvest the flaxseeds of this brood may be found just above the crown or just above one of the joints. The main fall brood appears from the last of August to the middle of October, the maximum emergence probably occurring during the last of September. The life cycle is repeated, and after the first of November the flaxseed stage is found just above the crown between the leaf sheath and the stalk. The winter is passed in this stage, and the main spring brood emerges from these flaxseeds. Under favorable conditions a brood of flies may also appear during midsummer and develop on the volunteer wheat. Occasionally a small supplementary brood of flies emerge from the volunteer wheat late in November.

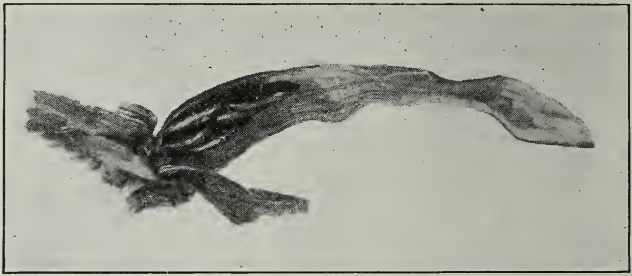

FIG. 3.—Hessian fly puparia or flaxseeds in position between the leaf sheath and stalk, two times natural size.

The length of the life cycle is extremely variable, due almost entirely to climatic conditions. Dry, cool weather lengthens the life cycle, while moist, warm weather shortens it. Excessive dry weather and heat also lengthen it.

The number of broods is also variable, ranging from two to five. In 1908 five broods were determined in the field—the main spring, supplementary spring, midsummer, main fall, and supplementary fall. In 1913 only three broods were determined—the main spring, supplementary spring, and main fall. In very dry years, when the drouth begins early, the supplementary spring brood might also be eliminated.

MAY 12, 1914.

5-2528

KANSAS STATE PRINTING OFFICE. W. C. AUSTIN, State Printer. TOPEKA. 1914.

FEB 9 1916

Kansas State Agricultural College

EXPERIMENT STATION—Circular No. 38

FEED CONTROL SECTION

The Kansas Feeding-Stuffs Law Revision of 1913

REGULATIONS AND EXPLANATIONS

WHAT FEEDS DO NOT REQUIRE REGISTRATION AND LABEL

1. Whole seeds or grains.
2. Whole hays, straws, and corn stover, when not mixed with other material.
3. Cottonseed cake, cottonseed meal, or other cottonseed products.
4. All other materials containing sixty per cent or more of water.

WHAT FEEDS MUST BE REGISTERED AND LABELED

1. All feeds except those mentioned above require registration and label. Some of the common feeds requiring registration and label are: Corn chop, kafir chop, oats chop, ground, cut, or chopped alfalfa, bran, shorts, wheat mixed feed, corn bran, corn chop and bran mixed, corn-and-cob meal, bran and screenings, wheat mixed feed and screenings, shorts and screenings, oil meal, meat meal, bone meal, blood meal, tankage, all poultry feeds, all mixed feeds, etc.

INFORMATION REQUIRED UPON THE LABEL

1. Name and principal address of person or firm responsible for placing the feed upon the market.
2. Minimum ***net*** weight of the contents of the package.
3. Name, brand, or trademark of the feed.
4. The guaranty:

Protein, not ***less*** than..........%
Fat, not ***less*** than..............%
Crude fiber, not ***more*** than......%

5. The specific name of each ingredient used in manufacturing the feed.

(In case any adulterant mentioned in Section 12 of the law is added to the feed, the maximum per cent. must be stated upon the label. In this connection attention is called to the fact that unwholesome or injurious materials must not be used in the manufacture of feeds.).

A good form of label is as follows:

99 Lbs. Net Weight
I. X. L. FEED
Composed of
Alfalfa, Corn Chop, Kafir Chop, Wheat Bran,
and not over 5% of Corn Bran
GUARANTY
Protein, not less than.................. 14.5%
Fat, not less than........................ 3.7%
Crude Fiber, not more than.............. 20.3%
Manufactured by
JOHN DOE MILLING CO.,
Doeville, Kan.

WHEN DO REGISTRATIONS EXPIRE

1. All registrations expire on June 30 of the fiscal year during which they are filed.

REGISTRATION FEE

1. Flour mills having capacity to manufacture more than three hundred barrels of flour in each twenty-four hours are required to pay an annual registration fee of $12.50 for each brand of feeding-stuff sold in this State.

2. Flour mills having capacity to manufacture more than fifty barrels and not to exceed three hundred barrels of flour in each twenty-four hours are required to pay an annual registration fee of $10 for each brand of feeding-stuff sold in this State.

3. Flour mills having capacity to manufacture not to exceed fifty barrels of flour in each twenty-four hours are required to pay an annual registration fee of $5 for each brand of feeding-stuff sold in this State.

4. In case the same brand is manufactured at more plants than one, a separate registration fee shall be paid as herein provided on said brand for each separate manufacturing plant.

CHANGES IN COMPONENTS OR IN GUARANTY

1. Before any changes can be made in the components or in the guaranty of any registered feed, application for permission to make such change must be made to the Feed Control Section. If the reasons given for making the change are deemed satisfactory, permission will be granted.

DEFINITION OF THE TERM "BRAND"

1. "The term 'brand,' as used in this act, is to be taken to mean: First, the name, trademark, or other designation under which a commercial feeding-stuff is sold; and second, the feeding-stuff itself."

It should be noted that separate registration will be required upon the various brands or grades of shorts.

COMMERCIAL FEED DEFINITIONS AND STANDARDS

1. **Pure Wheat Bran** shall consist of the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual

process of commercial milling. ***Standard Guaranty*** which must be equaled: minimum protein, 14.5 per cent.; minimum fat, 3.5 per cent.; and maximum crude fiber, 10 per cent.

2. **Wheat Bran and Screenings** shall consist of the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling, plus the various impurities separated from the wheat during the cleaning process and known collectively as ***Screenings.*** ***Standard Guaranty*** which must be equaled: minimum protein, 14.5 per cent.; minimum fat, 3.5 per cent.; and maximum fiber, 10 per cent.

3. **Standard Wheat Shorts** shall consist of the fine particles of the outer bran, the inner or "bee wing" bran, germ, and the offal or fibrous material obtained in the last reductions on middlings. ***Standard Guaranty*** which must be equaled: minimum protein, 16 per cent.; minimum fat, 3.5 per cent.; and maximum fiber, 5.5 per cent.

4. **Wheat Brown Shorts** as compared with standard shorts contain mostly the fine particles of bran and germ, and contain much less of fibrous offal obtained from the "tail of the mill." ***Standard Guaranty*** which must be equaled: minimum protein, 16 per cent.; minimum fat, 3.5 per cent.; and maximum fiber, 6.5 per cent.

5. **Wheat White Shorts** as compared with standard shorts shall contain a smaller portion of the fine bran particles and germ and a much greater portion of the fibrous offal from the "tail of the mill." ***Standard Guaranty*** which must be equaled: minimum protein, 14.5 per cent.; minimum fat, 3 per cent.; and maximum fiber, 3.5 per cent.

If to any of the above brands of shorts there should be added, either ground or unground, bolted or unbolted, the various impurities separated from the wheat during the cleaning process and known collectively as ***Screenings,*** the same shall be registered, labeled, and sold as Standard Shorts and Screenings; Brown Shorts and Screenings; or White Shorts and Screenings, as the case may be, and each must equal the standard guaranty required for the pure product.

Screenings shall consist of the smaller imperfect grains, weed seeds and other foreign materials having a feeding value, separated in cleaning the grain. (Sand, dirt, or other substances without feeding value must be eliminated from screenings before they are added to any feed.)

The word ***Screenings*** shall appear as part of the label or brand name that is required and shall be printed in the same size and face of type as the remainder of the label. For example, ***"WHEAT BRAN AND SCREENINGS"*** and not ***"WHEAT BRAN*** and screenings."

6. **Pure Wheat Mixed Feed** shall consist of pure wheat bran and pure wheat shorts combined in the proportions obtained in the usual process of commercial milling. ***Standard Guaranty*** which must be equaled: Minimum protein, 16 per cent.; minimum fat, 3.5 per cent.; and maximum fiber, 8.5 per cent. The name of each ingredient, for example, pure wheat bran, pure wheat shorts, should also be given on the label. (This feed has commonly been known as Mill Run or Mill Run Bran.)

7. **Wheat Mixed Feed and Screenings** shall consist of the wheat bran and wheat shorts to which have been added the various impurities separated from wheat during the cleaning process and known collectively as ***Screenings.*** The name of each ingredient—wheat bran, wheat shorts, and wheat

screenings—and the maximum percentage of screenings shall appear on the label. ***Standard Guaranty*** which must be equaled: Minimum protein, 16 per cent.; minimum fat, 3.5 per cent.; and maximum fiber, 8.5 per cent.

8. **Chop** shall be composed wholly of ground, cut, or chopped kernels of grain from which no portion has been abstracted for the manufacture of other substances and to which no other substance has been added. If it is sold under the name of any one cereal, it must be composed of that cereal only.

9. **Corn Chop** shall be composed wholly of ground, cut, or chopped kernels of corn from which no portion has been abstracted for the manufacture of other substances and to which no other substance has been added. ***Standard Guaranty*** which must be equaled: Minimum protein, 9 per cent.; minimum fat, 3.5 per cent.; and maximum crude fiber, 3.5 per cent.

10. **Corn Bran** shall consist of the coating of the corn kernel as produced in the usual process of commercial milling.

11. **Hominy Meal, Hominy Feed, or Hominy Chop** is a mixture of the bran coating, the germ, and a part of the starchy portion of the corn kernel obtained in the manufacture of hominy grits for human consumption.

12. **Alfalfa Meal** is the entire alfalfa hay, ground, and shall not contain an admixture of ground alfalfa straw or other foreign materials.

13. **Linseed Meal** is the ground residue after extraction of part of the oil from ground flax seed.

14. **Blood Meal** is ground dried blood.

15. **Meat Scrap and Meat Meal** are the ground residues from animal tissue exclusive of hoof and bone. If they contain any considerable amount of bone they must be designated **Meat and Bone Scrap,** or **Meat and Bone Meal.** If they bear a name descriptive of their kind, composition, or origin, they must correspond thereto.

16. **Digester Tankage** is the residue from animal tissue exclusive of hoof and horn specially prepared for feeding purposes by tanking under live steam, drying under high heat, and suitable grinding. If it contains any considerable amount of bone, it must be designated **Digester Meat and Bone Tankage.**

CAUTIONS

Careful observation of the following points will enable you to avoid more or less difficulty in registering your feeds and otherwise complying with the law:

1. **Be sure to fill in carefully and properly all spaces on the application blank.**

2. Do not register under firm name and then use some other name on label.

3. In filling in name of brand, use the exact name which you expect to place upon your label. For example, do not register wheat shorts and then expect to sell "brown shorts," "white shorts," or "white middlings" under this registration.

4. Give the name of each ingredient used in making up the feed.

5. When the term "bran" is used without any qualifying word, it will be assumed that it refers to ***wheat*** bran only.

6. In making up samples for analysis, small samples should be taken from a number of different sacks, or taken from the spout at different

times during the run. These samples should be thoroughly mixed and an average sample consisting of at least two pounds be forwarded for analysis.

7. In making up the guaranty from results of analysis, the percentages of protein and fat should be slightly lowered and the percentage of crude fiber should be raised somewhat to provide for differences in composition of the raw material or slight variations in the manufacturing process, but in no case should the guaranty of a feed for which a standard has been adopted, show a less per cent. of protein or fat or a greater per cent. of crude fiber than the standard. (See table of feed standards.)

8. Manufacturers having difficulty in determining proper guaranties are invited to write to the Feed Control Section regarding this difficulty.

9. **Keep a record in your office of all feeds registered, together with their components and guaranties.**

10. Be sure that all feeds leaving your plant are properly registered and labeled.

11. Dealers should see that all feeds are properly labeled before exposing them for sale. When tags are torn off in handling, duplicate tags must be attached.

CHANGES IN THE LAW

1. Condimental or medicated stock foods, proprietary medicines, etc., are placed under separate law known as "Live Stock Remedy Law."

2. The specific name of each ingredient must be stated on the label. In case the feed is adulterated with any foreign mineral matter, or other foreign substance such as rice hulls, chaff, corn-cob meal, corn bran, oat hulls, oat clippings, or other materials of less or of little or no feeding value, the kind and maximum amount of such mixture must be stated upon the label.

3. All whole meals or chops must be registered and labeled.

4. All cottonseed products are exempted by amendment offered in the legislature.

5. **Tonnage Tax.** A tax tag, or label, purchased from the Feed Control Section must be attached to each package, lot, or parcel of the following feeds: All poultry foods, linseed oil meal, linseed oil cake, or the feeding-stuff by-products of starch factories, glucose factories, cereal breakfast food factories, breweries and distilleries, meat packing establishments, or slaughter houses. ***No registration fee*** is required on these products. However, each application for registration ***must be accompanied*** by an order for $5 worth of tags for each brand offered for registration. If it is desired that tags or labels be sent by mail, postage must be included in the order.

APPLICATION BLANKS

1. All applications for registration must be made on blanks furnished by the Feed Control Section. Each application must be accompanied by the necessary registration fee, made payable to the Feed Control Section, or, in case of feeds on tonnage tax basis, by an order for not less than five dollars' worth of stamps or tags for each brand of feed registered.

REGISTRATION SAMPLES

1. Samples of all feeds must be sent prepaid with the application for registration. A registration sample should consist of at least one pound.

COPY OF LABEL

1. In order to avoid misunderstandings, it is requested that a sample tag, or copy of the label required by Section 2 of the law, be submitted with each application for registration.

ANALYSIS OF SAMPLES

1. If the manufacturer or seller desires the Experiment Station to make chemical analysis of sample to determine fat, protein, and fiber required in the guaranty, this work will be done at the following rates: Charge for determining fat $2, protein $2, crude fiber $4, or all three for $5. The Experiment Station does not guarantee that the analysis made of samples submitted by a manufacturer or seller is representative of the product sold by each manufacturer or seller. The Station merely guarantees that the composition of the sample submitted is as reported. Manufacturers and sellers taking samples for analysis should be extremely careful to secure a representative sample. Their attention is called to Caution 6 for directions in taking such samples.

TABLE OF ANALYSIS OF MILL PRODUCTS AT KANSAS STATE AGRICULTURAL COLLEGE, 1913-1914

COMMODITY	PROTEIN			FAT			CRUDE FIBER			No. Samples
	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	
Pure Wheat Bran..	19.3	14.3	16.7	5.1	3.4	4.3	12.2	7.4	10.1	25
Wheat Bran and Screenings........	19.9	15.0	16.7	5.6	3.4	4.2	12.4	6.6	10.3	50
Wheat Bran and Scourings.........	17.9	15.3	16.6	4.5	4.1	4.4	11.0	9.5	10.2	4
Corn Bran..........			12.6			10.1			8.3	1
Standard Wheat Shorts............	20.5	14.2	17.3	5.9	2.6	4.3	8.9	2.2	5.4	53
Stan. Wheat Shorts and Screenings ...	20.7	15.3	18.3	4.8	3.6	4.3	8.2	4.5	5.8	19
Wheat Brown Shorts	18.9	12.3	17.0	5.4	3.6	4.7	9.0	3.5	6.7	7
Wheat White Shorts	17.1	16.5	16.8	4.1	3.2	3.5	5.3	4.5	4.9	3
Pure Wheat Mixed Feed.............			17.3			4.3			8.3	1
Wheat Mixed Feed and Screenings ...	18.7	16.5	17.2	4.4	3.2	4.1	9.7	6.1	8.3	5
Corn Chop..........	11.8	6.8	9.6	4.7	1.9	3.4	3.3	1.1	2.2	79
Wheat Chop........	19.1	11.4	14.3	3.2	1.5	1.8	5.5	1.5	2.8	33
Rye Chop...........	13.2	11.5	12.1	1.9	1.6	1.7	3.5	1.9	2.6	11
Kafir Chop..........	11.5	10.3	11.0	3.4	2.5	3.0	2.2	1.4	1.9	3
Hominy Feed	12.2	10.7	11.1	8.6	6.9	7.5	6.7	2.4	5.3	5
Linseed Meal	37.0	32.7	34.2	12.2	6.9	8.8	11.4	6.7	9.6	9

FEED STANDARDS

	PROTEIN, Not Less Than	FAT, Not Less Than	CRUDE FIBER, Not More Than
Pure Wheat Bran	14.5 per cent	3.5 per cent	10.0 per cent
Wheat Bran and Screenings	14.5 per cent	3.5 per cent	10.0 per cent
Wheat Bran and Scourings	14.5 per cent	3.5 per cent	10.0 per cent
Standard Wheat Shorts	16.0 per cent	3.5 per cent	5.5 per cent
Standard Wheat Shorts and Screenings	16.0 per cent	3.5 per cent	5.5 per cent
Wheat Brown Shorts	16.0 per cent	3.5 per cent	6.5 per cent
Wheat White Shorts	14.5 per cent	3.0 per cent	3.5 per cent
Wheat White Shorts and Screenings	14.5 per cent	3.0 per cent	3.5 per cent
Pure Wheat Mixed Feed	16.0 per cent	3.5 per cent	8.5 per cent
Wheat Mixed Feed and Screenings	16.0 per cent	3.5 per cent	8.5 per cent
Wheat Mixed Feed and Scourings	16.0 per cent	3.5 per cent	8.5 per cent
Corn Chop	9.0 per cent	3.5 per cent	3.5 per cent

CORRESPONDENCE

1. All correspondence relating to the registration of feeding-stuffs should be addressed to the Feed Control Section, Experiment Station, Manhattan, Kan.

PURPOSE OF THE LAW

1. The whole intent and purpose of the Feeding-stuffs Law is to compel each feed to be sold for exactly what it is and upon its own merits. A consumer is entitled to know what he is buying and paying for. A manufacturer, or dealer, is entitled to know what is being sold. The fact that a feed is registered is evidence that it contains nothing harmful, if properly used. The declaration of the manufacturer must be true to fact if the feed is registered. The inspection and analysis at frequent intervals informs the director of the Experiment Station of the reliability of the manufacturer's or seller's guaranty. If the feed does not come up to the guaranty, the license will be revoked. The law is a protection to the consumer, dealer, and manufacturer.

W M Jardine

Director.

June 1, 1914.

KANSAS
STATE
AGRICULTURAL
COLLEGE

K
Department
of Printing

KANSAS STATE AGRICULTURAL COLLEGE

Agricultural Experiment Station

CIRCULAR NO. 39

OFFICE OF STATE DAIRY COMMISSIONER

Cream Grading for Kansas

Geo. S. Hine, Commissioner

A circular explaining why cream should be purchased according to grade, and giving rules on which the grading may be based

More than $1,000,000 loss annually is incurred to our state through the delivery and sale of inferior grades of cream. The producer bears all of this loss.

MR. DAIRYMAN, WHAT GRADE OF CREAM ARE YOU DELIVERING? ARE YOU RESPONSIBLE FOR A PART OF THIS LOSS?

WHY THIS DIFFERENCE IN VALUE.

It is impossible to make first grade butter from second grade cream. The most modern equipment and the most efficient men obtainable are both to be found developed to the highest point in our Kansas creameries. Nevertheless, it is impossible for these experts with this equipment to produce a high grade product from poor cream. It is this high development of our creameries which is largely responsible for the recognition our butter receives today on the large markets where it must be sold in competition with butter from Minnesota and Wisconsin. The butter from these states is made from cream delivered to the factory in far better condition than is our Kansas product.

Some idea of the prices received for the different grades of butter may be determined by looking over the following table which is based on the prices received in New York during the months of January, February, and March of this year.

Average prices paid for butter on the New York Market for the week ending:

	Extras	Firsts	Seconds
Jan. 10	35¾—36½	28⅞—34¼	24⅜—28
Jan. 17	33¼—33½	28¼—32¼	24½—27¾
Jan. 24	31 —31½	28 —30½	25 —27¼
Jan. 31	27⅞—28¾	26 —27¼	23½—25¼
Feb. 7	26⅞—27¼	25¼—26⅝	23¼—25⅞
Feb. 14	28 —28½	26¼—27½	23⅓—25¾
Feb. 21	30¾—31	27¼—30	24 —26⅛
Feb. 28	31⅛—31½	27¾—30½	24 —26¾
March 7	30½—31¼	27½—30	24¾—26⅞
March 14	28 —28½	26 —27½	23 —25⅓
March 21	25⅞—26½	24 —25⅓	21¾—23⅛
March 28	26 —26½	24 —25½	22⅓—23½

The published market quotations are often misleading since they are based on the highest prices received for the grade known as "Extras." Especially is this true of Kansas butter since none of it grades high enough to sell better than "Firsts," and a great portion goes as the lower grades of "Firsts," with a considerable portion selling as "Seconds." For instance, the difference in the market quotation and the actual selling price of the different grades of butter for the week ending Jan. 10, would be the average market quotation for the week, 36 1-2c. The selling price of the greater portion of "Firsts" was 30c with "Seconds" selling for about 25c.

Who Receives the Benefit of this 11 1-2c Spread in Price?

Under our present buying system, the man delivering a second grade cream receives just as much a pound for his butter fat as does the man delivering a first grade cream and yet the butter made from these two grades of cream is sold for a difference of from 5 to 11 1-2c per pound. Is this a fair buying basis? Emphatically no! There is absolutely no justice in a system allowing the producer of an inferior cream, from which only an inferior grade of butter can be made, to receive the same price for his article as does the producer of a first grade cream from which a high grade butter can be made.

It costs more to produce a clean cream and requires more time to care for it properly and to keep it in such condition that it will grade first when delivered at the point of sale. The man delivering this kind of cream should be compensated for the extra work entailed.

Trial Month Beginning June 15, 1914.

Because of the points mentioned above, this department has always been in favor of a grading system. We have urgently advocated the adoption of a system based on quality. All creamery companies located in Kansas have finally agreed to adopt the following plan:

Cream will be purchased on grade for one month, beginning Monday morning, June 15, 1914. No difference will be made in price, however, until the end of the trial period, when, if successful, these companies propose, as suggested by the department, to make a three-cent difference in price between first grade and second grade cream. No third grade cream will be accepted.

Cream Grading.

Cream shall be graded according to the following rules:

First grade cream shall consist of cream that is clean, smooth, free from all undesirable odors, clean to the taste, and sweet or only slightly sour.

Second grade cream shall consist of cream that is too sour to grade as first, that contains undesirable flavors or odors in a moderate degree, that is foamy, yeasty, or slightly stale, or that is too old to pass as first grade cream.

Third grade cream shall consist of cream that is very old, rancid, mouldy, dirty, or curdy, and such cream will not be accepted by the creamery companies.

How to Get First Grade Cream.

To produce first grade cream, it is necessary that absolute cleanliness be observed in every detail and that the following rules be adopted and followed:

1. Wipe the cows' udders with a damp cloth before milking, or wash the udders when necessary.

2. Remove all milk from the barn immediately after milking and separate it at once.

3. Set the separator screw so that the cream will test about 35 per cent.

4. Wash, scald, and air the separator and all other milk utensils immediately after using.

5. Cool the cream immediately after separating it. Never mix warm cream with cold cream.

6. Keep the milk and the cream cool; this is best done by placing the cans containing them, in a tank of flowing water.

7. Stir all cream at least twice a day.

8. Do not allow the cream to freeze.

9. Deliver the cream as required by section 8 of the dairy law, which reads as follows:

> "Cream to be used in the manufacture of butter that is not delivered to point of shipment within twenty-four hours after milking, must contain not less than twenty-five per cent. of butterfat and shall be delivered in wholesome condition."
>
> "No part of any shipment of cream to be used in the manufacture of food products shall be more than three days old when delivered to the point of shipment during the MONTHS of May to October, inclusive, and four days old during November to April, inclusive."
>
> "Such cream must not be delivered at the point of shipment more than one hour before the schedule time of the train on which it is to be shipped, unless kept in a protected, cool, and sanitary place free from foul odors."

10. Keep the receptacles containing milk and cream covered with a wet blanket while delivering these products in warm weather.

Do not fail to ask your operator what grade of cream you are delivering and how you can improve the quality.

If this grading system is adopted after the trial month, do not blame the operator if your cream does not grade first; find out and remedy the evil. Everyone can produce first grade cream. Remember, the operator has to pay the difference out of his own pocket, if he gives you a first grade price for a second grade cream.

How The Department Will Help You.

The state dairy commissioner's department stands ready and anxious to help anyone desiring assistance in any of the following points:

How to improve the quality of milk and cream.

Proper location and method of constructing a milk house.

Proper location and method of constructing a sanitary dairy barn.

Proper method of sampling and testing milk and cream.

Kansas State Agricultural College.

AGRICULTURAL EXPERIMENT STATION.

CIRCULAR NO. 40.

AUGUST, 1914.

VETERINARY DEPARTMENT.

SUGGESTIONS THAT WILL ASSIST IN THE PREVENTION AND CONTROL OF HOG CHOLERA.

F. S. SCHOENLEBER.

On all farms where hog cholera now exists, and on all farms where hogs died last year, the following method of cleaning and disinfecting should be followed:

NO. 1. INFECTED HOG HOUSES AND BARNS. These places should be swept and thoroughly cleaned, and the litter hauled out and burned. They should then be thoroughly sprayed inside and out with a three per cent solution of compound cresol.

NO. 2. INFECTED HOG LOTS AND PENS. All infected hog lots and pens should be raked over and scraped and all material collected in a pile and burned. All material that can not be burned should be spread on fields which hogs can not visit. The hog lot should then be covered with freshly slaked lime. Fences and posts should be sprayed with a three per cent solution of compound cresol. Spaces under barns and sheds which are accessible to hogs should be boarded up.

NO. 3. INFECTED PONDS AND WALLOWS. Infected ponds should be drained and thoroughly covered with lime. These infected ponds and wallows are a source of infection that remain for years on a farm, and it is practically impossible to completely disinfect them. It is advised that where these ponds can not be drained they should be fenced hog-tight. All wallows should be well covered with lime and filled in.

No. 4. Infected Straw Stacks. It is an exceedingly bad farm practice to permit hogs to lie around straw stacks, especially in the winter time, as they become overheated and readily contract pneumonia. Where cholera-infected hogs have had access to a straw stack, the stack will remain a source of infection for a long period of time, and it is advisable to completely destroy the stack by burning. Where impracticable to burn the straw stack, the straw should be raked out from the sides and around the base and removed and burned. The soil around the base of the stack should then be covered with air-slaked lime and plowed.

No. 5. Infected Wood and Grass Pastures and Fields. Where cholera-infected hogs have access to large fields or tracts of timber, it is impossible to satisfactorily disinfect same, and it is advised not to permit healthy hogs on these infected places under four months.

It is further advised, where it is positively known that sick animals have lain or died, to thoroughly saturate the ground in and around these places with a three per cent solution of compound cresol, or cover same with air-slaked lime.

METHODS OF PREVENTION.

When a herd of hogs in your immediate neighborhood becomes infected you can, in a large percentage of cases, prevent the disease from coming to your farm by observing the following regulations:

REGULATIONS.

1. Remove all healthy animals to inclosed, uninfected ground or pen. This pen should be located so as not to be near a public highway, a railroad or a stream.

2. Do not allow any communication between your hog lots and those of your neighbors, as cholera may be carried very easily on a person's shoes.

3. Observe cleanliness, both as to the surroundings and as regards the feed, to prevent its becoming infected. Wagons that have been used to carry infected dead hogs will infect corn or other feed, and thus bring the disease to your farm.

Frequent cleaning and burning of the litter in your hog pens will destroy any latent infection.

4. Repeated and regular use of disinfectants in your hog pens, feeding troughs and buildings should be practiced, using a three per cent solution of compound cresol.

5. Do not put new stock, either hogs or cattle, with hogs already on your farm. Newly purchased hogs should be put in separate enclosures well separated from the herd now on the farm, and kept under observation for three weeks. This is necessary, as all stock cars, unloading chutes and pens are liable to be infected with hog cholera, and hogs shipped by rail are especially liable to contract the disease.

Burn up all carcasses of dead cattle, horses, hogs, sheep or dogs on the day they die. Do not allow dogs, chickens, or hogs to have access to a dead carcass. The feeding of a partially burned carcass is dangerous, especially that of a hog that died from cholera, as hog cholera germs exist in the marrow of the bones, and an entire herd may become infected in this way. A dead carcass that is not burned immediately attracts buzzards and dogs to your farm, that may have come from a farm infected with cholera, miles away.

The burying of dead animals is very unsatisfactory, unless they are put at least two feet underground and covered with lime at the time of burial. Hog cholera infection frequently occurs by the digging up by dogs, months after burial, of the carcasses of hogs that have died from cholera.

HOW HOG CHOLERA MAY COME ON YOUR FARM.

1. Pigs and hogs purchased from an infected herd, or coming in contact with those from infected farms, or running over grounds that were occupied by cholera-infected hogs within four months.

2. Infected streams may communicate the disease to the herds below the source of infection.

3. The disease may be carried in feed, implements used on the farm, and on the feet and clothing of persons from infected herds and premises.

4. Dogs, birds, buzzards, pigeons, chickens, etc., that have access to diseased premises, or diseased carcasses, may transport the hog cholera virus.

5. Any dead animal, whether it be a horse, cow, dog, chicken, or hog, if permitted to remain unburned, is a source of infection, as buzzards and dogs feeding upon this carcass may have come from an infected farm.

Approved:
W. M. JARDINE,
Director Experiment Station.

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KANSAS STATE AGRICULTURAL COLLEGE

Agricultural Experiment Station

CIRCULAR NO. 41

VETERINARY DEPARTMENT

ACTINOMYCOSIS OR LUMPY JAW

R. R. DYKSTRA

This is a non-contagious disease caused by the entrance into the animal tissues of a fungus known as the "ray fungus." This fungus is found on hay, alfalfa, fodder, grain, etc.

Small wounds in the lining membrane of the mouth or tongue, or decayed teeth permit the fungus to get into the tissues. Sometimes the fungus is inhaled, lodging in the lungs. It may lodge in castration or other wounds, or it may pass into the udder through the milk ducts. It produces its characteristic symptoms in those parts in which it becomes lodged.

Cattle are most frequently infected, especially in the region of the head; swine are commonly infected in the udder, while the disease is quite rare in horses, sheep, goats, dogs, or man.

Symptoms

These vary according to the location of the ailment. In cattle the skin in the region of the lower jaw is the most common seat of the disease. A round swelling develops at this place, usually quite firm, and generally firmly adherent to surrounding parts. It may break open, discharging a thick, yellow, sticky pus, the inside of the swelling becoming filled with raw, easily bleeding tissue.

When the bone of the jaw is primarily involved it becomes much thickened, throwing out masses on its external surface, and frequently interfering seriously with mastication, so that the animal becomes unthrifty.

Sometimes the lips are affected, becoming much thickened and hardened, or firm, round enlargements may be felt in their substance. Occasionally the tongue is the seat of the trouble, sores developing on its upper surface, especially towards the hind part of this organ. In the course of time the muscles of the tongue may become involved, causing a stiffening, the so-called "wooden tongue," which interferes with mastication, causes salivation, and produces a bad odor. The tip of the tongue, owing to its swollen condition, may be forced out of the mouth.

Actinomycosis of the lungs is comparatively rare. The animal shows no characteristic symptoms to distinguish it from any other lung trouble. There is usually in the advanced stage difficult breathing, coughing, and the animal loses flesh. It may be distinguished from tuberculosis by the tuberculin test.

The udder, when infected, becomes either uniformly hardened and may be enlarged, or small, round, hard masses may be felt in the interior. These latter are usually filled with thick pus.

Prevention

When large numbers of animals in a herd are affected it is advisable, if possible, to keep them away from low, swampy soil as grazing ground. A change of feed is desirable; or the same feed may be used if it is first steamed or scalded.

Treatment

The best line of treatment is to cut the growth out completely. This is easily accomplished when it is not firmly adherent to surrounding parts, or where it has not infiltrated neighboring structures. The wound thus produced should afterwards be washed out daily with a 2 per cent. watery solution of carbolic acid.

When the growth cannot be totally removed, it may be cut open, the pus washed out with a 2 per cent solution of carbolic acid and water, and the wound packed with a piece of cheesecloth that has been saturated with tincture of iodine. The gauze may be left in position for twenty-four or forty-eight hours.

In those cases where the growth cannot be cut out, or if it does not contain pus, but is hard, a large cattle trocar and canula may be passed into the most prominent part of the enlargement until the center is reached. The trocar is then withdrawn, a piece of trioxide of arsenic the size of a bean is forced into the canula and the latter withdrawn, leaving the arsenic in the tumor. In the course of from four to eight weeks the entire tumor drops out.

When the tongue is affected, and in the early stages, several superficial incisions may be made in the surface, and afterwards painted with tincture of iodine.

Finally, when the preceding forms of treatment cannot be carried out, the iodide of potash treatment may be adopted. It is as follows: Young animals should receive from one half to one dram of iodide of potash in the drinking water daily. Adult animals should receive from two to three drams daily. This treatment should be continued from four to six weeks, or until the growth has disappeared. If, during this treatment, the eyes commence to water, with an excessive nasal discharge, skin eruptions, loss of hair, and emaciation, then the dose must be decreased or discontinued for a week. This treatment is successful in about 75 per cent of all cases treated. The milk should not be used during this treatment, nor when the udder is the seat of the trouble.

Illinois

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Insert in

Vol went up 29 May 18

KANSAS STATE AGRICULTURAL COLLEGE

Agricultural Experiment Station

CIRCULAR NO. 42

OFFICE OF STATE LIVE STOCK REGISTRY BOARD

C. W. McCAMPBELL, Secretary

Which Stallion and Why?

1. The breeding season is near at hand and every mare owner should study carefully the following questions:

- *a.* Why am I raising horses?
- *b.* What types and classes of horses are needed in large numbers on the farm and in the city?
- *c.* What types and classes of horses are no longer needed on the farm or in the city?
- *d.* Which type have I been raising?
- *e.* How much does it actually cost me to raise a colt to maturity?
- *f.* Have I been raising horses at a profit or at a loss?
- *g.* Do I really appreciate the value of a good, sound, pure-bred sire and am I willing to pay a reasonable fee for the service of such a sire?

2. The whole country is over stocked with common and inferior horses for which there is no particular need or demand because they have proven to be an inefficient form of motive power, not only on the city streets but also on the farm. Some one has said the successful farmers make their money loading heavy, active horses with all they can drag away. The heavy, active horse is the one the farmer needs and the market wants. Horses of this class are bringing more money today than ever before. This is proven by the average price paid on the Chicago market for the past ten years for all that would class as draft horses. These interesting figures for various years run as follows:

Year	Average Price	Year	Average Price
1905	$186.00	1911	$205.00
1907	194.00	1913	213.00
1909	194.00		

3. The profitable and efficient horse can be produced only by keeping the best mares on the farm and breeding them to the *good, sound, pure-bred sire.*

4. Only fifty-five per cent. of the stallions licensed to stand for public service in Kansas are pure-bred. This means that forty-five per cent., or nearly half, are grades and scrubs—the kind that sire

(Stallions of your county listed inside.)

SUMNER COUNTY

LIST OF STALLIONS LICENSED FROM JULY 1, 1913, TO OCTOBER 1, 1914

Owner	Post-office	Name and Number	Foaled	Breed	License Number	Condition of Soundness
		PURE-BRED				
Alloway, L. F.	Conway Springs	Idlewild 22015	1898	Percheron	4799	
Brown, Frank	Peck	Leo Thornton 39869	1904	Standardbred	1495	
Brummett, W. M.	Mayfield	Baccarat Jr. 19838	1906	French Draft	3146	
Buffington, Elmer J.	Oxford, R 2	Fenton 63125	1907	Percheron	3003	Sound
Buffington, Elmer J.	Oxford, R 2	Gold Dust 52782	1905	Percheron	3004	Sound
Buffington, Elmer J.	Oxford, R 2	Charles Chance 53665	1910	Standardbred	3005	Sound
Buffington, Elmer J.	Oxford, R 2	Chances Charles 56281	1911	Standardbred	3006	Sound
Buffington, J. M.	Oxford	Buffington's Angelico 89069	1911	Percheron	1320	Sound
Buffington, J. M.	Oxford	Allerton R 43660	1903	Standardbred	1321	Sound
Buffington, J. M.	Geuda Springs, R 2	Banquo 40986	1903	Percheron	1884	Sound
Buffington, J. M.	Oxford	Houler IV 95552	1912	Percheron	3664	Sound
Buffington, W. G.	Gueda Springs	Angelico 60363 (65379)	1905	Percheron	2770	Sound
Buffington, W. G.	Gueda Springs	Vendor Junior 38414	1902	Standardbred	2771	Sound
Burns, H. H.	Argonia	Brittain 77647	1909	Percheron	821	
Burns, H. H.	Argonia	Bow Shot Jr. 53605	1907	Standardbred	822	
Burns, H. H.	Argonia	Donald 93568	1911	Percheron	823	
Burns, H. H.	Argonia	Calvin 85900	1911	Percheron	824	
Clevenger, W. W.	South Haven, R 3	Micawber 22799	1894	Percheron	2916	
Dameron, H. F.	Perth	Figaro III 73410	1909	Percheron	2419	
Dayle, J. F.	Peck, R 2	Frenand 41351 (62087)	1904	Percheron	3595	
Dayle, J. F.	Peck, R 2	Charlie M 22427	1898	Percheron	4996	
Fitts, W. A.	Argonia, R 4	Ernesto 22081	1908	French Draft	2507	
Fitts, W. A.	Argonia, R 4	Idumee 77640 (80347)	1908	Percheron	2508	
Gile, J. A.	South Haven	Rex 77291	1910	Percheron	576	
Goerne, Gus	Milan	Corton de Keumiee 3278 (Vol. XV)	1906	Belgian	4142	
Grove, E. E.	Caldwell	Cophignou 3903	1907	Belgian	2208	
Hall, A. C.	Dalton	Jesse Knight 36786	1902	Standardbred	5534	
Hall, A. C.	Dalton	Platum 41043	1901	Standardbred	5535	
Hamilton Bros.	Belleplaine, R 1	Nicholas 44926	1905	Percheron	1960	

GRADE

Bender, J. A.	Belle Plaine, R 3	Langston	1906	Grade	French Draft	3127	......
Bender, J. A.	Belle Plaine, R 3	Norm	1902	Grade	Percheron	3128	......
Bretz, J. P.	Milton, R 1	Logan	1909	Grade	Percheron	287	......
Buffington, J. M.	Oxford	Black Jim	1912	Grade	Percheron	3663	Sound
Clark, Leigh	Conway Springs	John H.	1904	Grade	Standardbred	1255	......
Combs, E. M.	Argonia, R 1	Figaro II	1906	Grade	Percheron	1205	......
Dayle, J. F.	Peck, R 2	Vaudeville Star	1906	Grade	Percheron	3596	......
Dorsey, A.	Conway Springs R 4	Dodd	1903	Grade	Percheron	3059	......
Ellison, J. S.	South Haven, R 3	Duke	1910	Grade	Percheron	4136	......
George Bros.	Argonia, R 4	Honest John	1910	Grade	Belgian	476	......
Goerne, Gus	Milan	Bismark	1911	Grade	Belgian	4143	......
Gerjets, Meent H.	South Haven	Frank	1907	Grade	Percheron	1671	......
Harper, Miller	Milan	Black Ned	1911	Grade	Percheron	2286	......
Hubbard, T. A.	Wellington	Brilliant	1905	Grade	Percheron	3818	......

Miller, J. F.							
Morris, L. L.	Wellington	Chebec					
McCammon, Worder H.	Mayfield	Cap	1912	Grade	Percheron	5077	
O'Connor, T. J.	Argonia, R 1	Coley	1909	Grade	Percheron	2488	
Pennington, Mrs. B. A.	Caldwell, R 2	Sam	1909	Grade	Cleveland Bay	4784	
Pope, T. G.	Caldwell, R 2	Tom	1908	Grade	Belgian	2103	
Ramsey, Clyde	Wellington, R 6	Sampson	1908	Grade	Percheron	813	
Reece, D. W.	South Haven, R 3	Rushon	1899	Grade	Standardbred	237	
Reece, J. S.	Oxford	George	1911	Grade	Percheron	2629	Sound
Reynolds, W. H.	Conway Springs	Bill	1912	Grade	Percheron	4315	Sound
Rhodes, Elton	Corbin, R 1		1911	Grade	Belgian	4968	
Schmidt, Henry	Caldwell, R 3	Dan	1908	Grade	Percheron	2023	
Schwarz, F. J.	Ashton	Black Dimond	1907	Grade	Percheron	1519	
Shade & Roady	Caldwell, R 4	Bunkum	1908	Grade	Percheron	3806	
Smith, F. L.	Wellington	Prince	1909	Grade	Percheron	4407	Sound
Solomon, Thos.	Wellington, R 7	Ned	1912	Grade	Percheron	4113	Sound
Stephenson, E. H.	Milton, R 1	Sam	1911	Grade	Percheron	3969	
Stewart, E. T. and Hebbard, G. M.	Milan	Teddy	1908	Grade	Percheron	3167	
Syfert, J. W.	Ashton, R 1	Devaul	1906	Grade	Percheron	1052	
Thompson, W. W.	Perth, R 1	Ben	1906	Grade	Percheron	2704	
Turley, G. W.	Wellington	Nealy Todd	1903	Grade	Standardbred	4612	
Woods, Leo	Geuda Springs	Crown Prince	1903	Grade	French Draft	2153	

SCRUB

Barber, John I.	Corbin, R 1	Mike	1902	Scrub		2918	
Baumgardner, C. H.	Geuda Springs	Prince	1904	Scrub		2038	
Corzine, J. A.	Caldwell	Plato	1909	Scrub		2705	
Douthitt, Roy H.	Oxford, R 2	Stephen Fleet	1905	Scrub		2474	
Dugan, C. E.	South Haven, R 1	Pat Denning	1905	Scrub		3039	
Endres, S. H.	Milton	Fox	1902	Scrub		1820	
Endres	Milton	Gay Boy	1902	Scrub		1821	
Ewing, W. R.	Conway Springs R 2	John	1899	Scrub		4754	
Geetz, Jacob	South Haven, R 1	Prince	1911	Scrub		3978	
Gibson, Joseph	Caldwell, R 3	Black Eagle	1909	Scrub		3280	
Haun, S. N.	Wellington, R 4	Shade	1902	Scrub		2382	Sound
Hobson, John	Conway Springs R 1	Dodd's Jr.	1905	Scrub		681	
Lamunyon, J. O.	Perth, R 1	Dock	1904	Scrub		1597	
Love, C. F.	Conway Springs R 2	Dock	1905	Scrub		3188	
Miller, J. S.	Clearwater, R 3	Bob	1910	Scrub		1844	
McDermott, Tom	Argonia	Coloton Jr.	1906	Scrub		5573	
Paxson, E. G.	Conway Springs R 1	Barney	1908	Scrub		575	
Rains, J. W.	Caldwell	Taft	1909	Scrub		4818	
Ramsey, C. U.	Geuda Springs	Prince	1906	Scrub		1360	
Shore, B. D.	Argonia	Starlight	1904	Scrub		2029	
Wheeler, F. V.	South Haven, R 1	Nig	1909	Scrub		3343	
Wilcox, J. T.	Mulvane	Black Prince	1899	Scrub		2039	
Wilson, W. M.	Wellington, R 1	B. D. Wilkes	1904	Scrub		2583	

Mossman, D. F.	Caldwell	Rasico 82108	1910	Percheron	4749	......
Neal, W. R.	Caldwell, R 1	Castillon Boy 59565	1906	Percheron	503	......
Poovey, W. H.	Belle Plaine, R 3	Fil D'Or 15882	1906	French Draft	568	......
Popplewell, W. J.	Rome	Kanneth G 60753	1908	Thoroughbred	5096	......
Reeves, D. A.	Conway Springs	L. Casino 92722	1912	Percheron	3836	......
Riggs, J. W.	Oxford	Tambour 54242 (44432)	1898	Percheron	4352	......
Rusk, Ira E.	Wellington	Kruger 63102	1908	Percheron	974	......
Rusk, Ira E.	Wellington	Diaz 86956	1911	Percheron	975	......
Schwarz, F. J.	Ashton	Pandore 25205 (43872)	1898	Percheron	1520	......
Seaman, C. W.	Oxford	Keota Budlong 27647	1900	Percheron	3465	Sound
Seaman, C. W.	Oxford	Forward Seaman 37929	1902	Standardbred	3466	Sound
Seitz, Alvah	Anson	Peerless 73409	1909	Percheron	4353	......
Shaklee, G. S.	Corbin, R 1	Fringant II 89212	1911	Percheron	2919	......
Shaklee, G. S., Kelly, E. E., and Blosser, D. F.	Corbin	Fringant 64780 (65191)	1905	Percheron	1953	......
Stewart, E. T., and Hebbard, G. M.	Milan	Freddy 4817	1901	German Coach	3168	......
Stunkel, E. L.	Peck	Monarch 86263	1911	Percheron	2200	......
Stunkel, E. L.	Peck	Castellanie 86262	1910	Percheron	2201	......
Stunkel, Henry	Peck	Famueil 46756	1906	Percheron	4870	......
Swaim, C. D.	Geuda Springs	Commander F 8781	1905	Shire	4382	......
Syfert, J. W.	Ashton, R 1	Oxford Coquette 53319	1910	Percheron	1051	......
Turley Bros.	Wellington, R 6	Jim Burr 44415	1905	Standardbred	4613	......
Walker, C. F.	Conway Springs R 3	Lionceau 90840 (99629)	1911	Percheron	2115	......
Ward, Lee	Hunnewell	Randal 46757	1906	Percheron	461	......
Warren, Oscar	Wellington, R 5	Jesse Knight Jr. 47214	1906	Standardbred	2325	......
Wilcox, J. T.	Mulvane	Balthazar 32302 (44420)	1898	Percheron	1357	......
Wilcox, T. J.	Mulvane	Granaud 58815 (70092)	1906	Percheron	4850	......
Woods, Leo	Geuda Springs	Chardon 46771	1905	Percheron	2152	......
Wood, Robert	Milan	Faro 49357	1906	Percheron	4354	......
Wornom, H. C.	Mayfield	Casio 42324	1903	Percheron	3152	......
Wornom, H. C.	Mayfield	Crampon 7362 (72748)	1909	Belgian	4724	......

the common, inferior and unprofitable class with which the country is now over stocked.

5. The only reason we have scrub sires in Kansas is because certain mare owners are willing to patronize them. These mare owners have not yet learned that it would be more profitable for them not to breed their mares at all than to breed them to a scrub stallion. Horses sired by inferior grade and scrub stallions can be bought more cheaply than they can be raised.

6. Many mare owners criticize owners of good stallions when they charge a $15 or $20 service fee. If mare owners knew more of the expense, risk, and work incident to owning and standing a stallion for public service, they would change their opinions very radically regarding what might be termed a reasonable service fee and would look upon the owner of a *good, pure-bred* stallion as a public benefactor. Investigation has shown that the average pure-bred stallion of Kansas costs approximately $1,000, and the figures given below relative to the business and expenses is the average of a very large number of cases and can be taken as approximately the average for the entire state.

	Average Business per Year	Average Expense per Year
40 living colts at $12.50..............	$500.00	
Feed and care of stallion per season	....	$250.00
Colts never paid for (20%)...........	....	100.00
Insurance ($80 per $1,000)............	....	80.00
Taxes (very variable)	....	10.00
Interest on investment at 6%.........	....	60.00
Depreciation (10% per year)	....	100.00
Total..........................	$500.00	$600.00

These figures show that from a strictly business standpoint the average stallion owner is keeping his stallion at an actual loss. The owner of a good, pure-bred stallion needs your support and encouragement, and you need the services of the good, sound, pure-bred sire. Are you willing to pay a reasonable fee for such service?

7. For years we have been sending immense sums across th- seas for breeding stock, but as the horse breeding countries of Contie nental Europe are now engaged in a war that has almost exterminated the leading breeds of horses of those countries we must, for many years, depend almost entirely upon our own resources for breeding stock. We can produce just as good breeding stock as Europe has produced, but in order to do this we must select our breeding stock more carefully and breed for more size, substance, quality, and action. The big, rugged, easy going quality horses are the useful, efficient, profitable kind, and the only ones we can afford to raise.

8. *Be sure to read the license issued for the stallion you may wish to patronize. It will tell you whether he is a pure-bred, grade, or scrub.*

9. *This license should be posted in a conspicuous place where you can easily see and read it.*

10. *Do not patronize a stallion standing for public service that has not been licensed. The owner of such a stallion is violating the law and is not worthy of your patronage.*

11. Any person who shall wilfully misrepresent the pedigree, stock, or blood of a stallion shall be punished by a fine not exceeding $500 or by imprisonment in a county jail for a period not exceeding one year, or by both such fine and imprisonment, *and shall forfeit to his patrons* all pay for services rendered for that season.

"Swat the Scrub."

KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Experiment Station.

CIRCULAR No. ~~42.~~ 43

DEPARTMENT OF ZOÖLOGY.

The Pocket Gopher.[1]

By Harry B. Yocom.

THE number of pocket gophers has been steadily increasing during the last several years, due, largely, to the increased acreage of alfalfa. Almost every field contains some of them, which are extending their burrows in every direction in search of the thick and succulent roots which grow deep enough to supply the wants of the animal. Living in these conditions the homes of the pocket gophers are rarely disturbed by the plow, and unless vigilantly fought by the landowner nothing prevents them from extending their tunnels and increasing their kind. Although extermination is almost impossible, yet by coöperation a community may so lessen their number that the damage to crops is practically negligible.

Distribution and Habits.

Two species of pocket gophers are found in Kansas. The prairie pocket gopher (*Geomys bursarius*) is abundant in the central and northeastern part of the state, but is replaced in the western part and in the Arkansas valley by the plains pocket gopher (*G. lutescens*). Although this latter species is not so numerous in the dry regions, it becomes as abundant in the lower Arkansas valley as the prairie pocket gopher does in any part of the state.

Unlike the greater number of burrowing mammals which spend much of their time above ground searching for food, the pocket gopher remains in the tunnels he has excavated, extending them in all directions and bringing the excavated earth to the surface, where it is deposited in mounds. It rarely comes out on the surface, except at times when it is necessary to push back the dirt from the opening, and then only for a brief space of time. Occasionally one is found wandering about on the surface, probably in search of a better food supply.

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[1] This is a résumé of Bulletin 172.

The gopher is not a prolific breeder, the average number of young being about four. They are usually born during March and April and are ready to establish burrows of their own by the next fall. At this season the young may be found running around, apparently in search of suitable fields for their work.

Crops Damaged.

While the most active season is in the late fall and early spring, the pocket gopher remains active all the year except at times when the ground is frozen too hard for mining. In the fall the animals are busy extending their burrows in search of food, which they store up in pockets excavated for that purpose. In the spring this activity is renewed, but later, during the breeding season and when the time comes for rearing the young, less earth is excavated.

Many crops are damaged by the gopher. However, none suffer as does the alfalfa. It is not only the growing alfalfa that is damaged by the roots being eaten off, but there is considerable loss due to the mounds thrown up in the fields, which hinder the harvesting of the crop. Often it is necessary to cut high in order to keep the machine from being clogged with dirt. Meadows of native grass are also damaged in this way. The roots of young trees in orchards and nurseries are often eaten off, causing a loss to the fruit grower. Occasionally large trees may have their roots so damaged that they fall during heavy winds. Potatoes, beets, turnips, parsnips and other fleshy rooted vegetables are also taken. Potatoes in piles are often stolen from beneath by gophers mining into a cellar and filling in the cavities with excavated dirt.

Gopher Legislation.

While there have been laws passed with the aim of combating the gopher, most of them have a weak place which makes them almost ineffective. There is a bounty law which requires all counties of the state to pay a bounty of five cents, or permits ten cents per head on the gophers killed. This law, however, discourages poisoning, which is by far the most effective means of getting rid of them.

Methods of Control.

Being an underground animal, the gopher has few natural enemies. Hawks and owls will take them, but as such a small amount of time is spent above ground these birds do not kill many of the rodents. Many house cats learn the trick of capturing them as they thrust their heads from the burrows when throwing out dirt. In some localities weasels and bull snakes are efficient enemies. However, the former are not numerous enough to be a great factor in the control, and few landowners and tenants are thoughtful enough to permit the increase of the bull snake to numbers sufficient to make him an aid in the destruction. Another animal that is important in the control is the little striped skunk. This animal is able to dig into the burrow at any point and corner the gopher in a pocket and make a meal of him. Even should the skunk take an occasional fowl, he more than pays for it in gophers killed.

POISONING. As stated above, poisoning is the most effective and easily applied method of ridding a badly infested farm. By this means one man can accomplish as much as half a dozen could with traps in the same length of time.

Several years ago the Kansas State Agricultural College began the manufacture of a poison which has proved to be very effective. This mixture is now sold by the College at $1.10 per quart, f. o. b. Manhattan. The method of using this poison is more favorable than other poison methods in that it is a great time-saver. Pour boiling water over as much shelled corn as needed—a quart poisons a half bushel—and let stand to swell and soften. Drain off the water and pour the poisoned syrup over the corn, and mix thoroughly so that the grains are well covered. (Sweet potatoes chopped fine may be substituted for the corn.) The corn as treated is introduced into the burrows by means of an old spoon. Openings into the burrows are made with a sharp iron or stick. This method is used to introduce other poisoned bait into the burrows. After the poison is introduced the mounds should be smoothed off so that fresh dirt may be recognized when thrown up.

Pieces of potato, apple, or sweet potato poisoned with strychnine crystals answer the purpose very well. Raisins and prunes treated thus have been found to give very good results.

Fumigation as a means of eradication has been tried, but results of experiments carried on at this station indicate that this is a very expensive method, considering the number of gophers killed. Besides being expensive, it is not as thorough as the poison, and in order to get satisfactory results must be repeated.

TRAPPING. While slow, there is no surer means of killing gophers than by traps. This method works well if the area to be cleared is small or if the animals are not numerous. Steel traps set in many different ways have been tried, but have been found, on the whole, to be less satisfactory than those designed especially for this animal. The principle of these traps is that of the spring rat trap, but built in the form of a box, into which the gopher thrusts his head when bringing dirt to the surface. The "California" gopher trap and the "O. K." gopher trap are similar in construction and of the above-mentioned design. Either will give good results, as will many others now on the market. The traps should be run twice a day to get the best results, and often a second gopher may be caught by resetting the trap at the same burrow.

Trapping or poisoning, to be most effective, should be carried on during late fall or early spring when the gophers are most active.

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KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Experiment Station.

CIRCULAR No. 44.

DEPARTMENT OF AGRONOMY.

COLLEGE OF A
READING ROOM

Sweet Clover.

C. C. CUNNINGHAM.

SWEET CLOVER, once considered a noxious weed, is now recognized as a valuable crop under certain conditions in Kansas. Until recently, sweet clover was grown only as a honey plant. It is now grown for soil-improvement purposes and as a pasture and forage crop, and its utilization for these purposes is steadily increasing. As a crop for soil improvement sweet clover is unexcelled; for pasturing purposes it has given satisfactory results; as a forage crop it can often be utilized to good advantage where alfalfa or red clover can not be successfully grown. However, as a dry-land crop or as a crop to be grown on upland, where alfalfa can not be successfully grown, because of insufficient moisture, sweet clover is yet in the experimental stage.

There are several varieties of sweet clover, of which the common white sweet clover (*Melilotus alba*) and the large biennial yellow sweet clover (*Melilotus officinalis*) are the most important. The white variety is most extensively grown in Kansas. It grows more vigorously and more upright and larger than the yellow variety and is generally to be preferred for farm purposes. Another variety, yellow sweet clover (*Melilotus indica*), is an annual, and is of very little value in Kansas.

Practically all of the soils in the state are adapted to growing sweet clover; very sandy soils, poorly drained acid soil, and possibly the "white ash lands" of southeastern Kansas, excepted. It thrives best on fertile land well supplied with lime, but will make a better growth on very poor soils than most other crops. When grown for hay it is best to plant on fairly fertile land. Where sweet clover is to be pastured it may be planted on the poorer soils and yet yield justifiable returns. It is not to be expected that sweet clover will make as great a growth on very sandy soils as on more fertile land. However, there are many places in western Kansas where sweet clover is bringing larger returns, from sandy soils along river bottoms where the underflow is near the surface, than any other crop that could be grown.

Sweet clover has been overrated for growing on upland soils in western Kansas. Results obtained during 1913 and 1914 in coöperative tests with sweet clover conducted throughout that portion of the state have not been encouraging. Considerable trouble was experienced in obtaining stands. When seeded early in the spring the young sweet-clover plants do not seem to be able to compete with the ever-present Russian thistle, unless growing conditions are very favorable throughout the season. The young plants are susceptible to drouth, and if the ground gets dry before the plants become well rooted they will die out. Grasshoppers relish the sweet clover, and if they are numerous will soon destroy a new stand. Because of the high price of the seed, the short life of the crop, and the chances of failure in securing a stand, sweet clover has not proved profitable as a forage crop on the uplands of western Kansas.

PREPARING THE SEED BED.

To seed sweet clover successfully a thoroughly compacted seed bed is necessary. There should be just enough loose soil on top to enable the seed to be covered. The lack of a solid seed bed is probably the chief reason why sweet clover so often fails when seeded upon cultivated fields. Under natural conditions it reseeds itself readily on the hard, compact soils along roadways, in prairie sod and vacant lots, where the seed is scattered by natural agencies, and covered by rains and the alternate freezing and thawing of the ground. Evidently there is greater danger of having the seed bed too loose than too firm when seeding sweet clover on cultivated land.

However, sweet clover responds readily to good preparation of the soil, and it will pay to thoroughly prepare the land. Where land is plowed the work should be done several months in advance of seeding time, so that the soil will have ample opportunity to settle. Satisfactory results can usually be obtained by seeding sweet clover on clean corn ground or after some other intertilled crop by using implements to prepare the seed bed that merely stir the surface soil.

SEEDING SWEET CLOVER.

Under natural conditions sweet clover remains in the ground during the winter and germinates in the spring, although occasionally a few seedlings may be found in the fall. It may be seeded any time from January to the last of May, with good chances of success. From the little data available it appears that early seeding is preferable in eastern Kansas. In the eastern third of the state it may often be successfully seeded with a nurse crop of oats or barley, provided the seed bed is not too loose and open and a rather thin stand of grain is grown. In favorable seasons good stands of sweet clover may be obtained by seeding with fall wheat, the sweet clover being sown in the late winter or early spring in the same manner that red clover is usually seeded. Seeding sweet clover with a nurse crop may result in failure if the season is excessively hot and dry immediately after harvest or if the small grain makes too heavy a growth and completely shades the young plants.

The amount of seed to use per acre varies with the quality of the seed and the per cent of "hard seed." Sweet clover may contain from ten to ninety per cent of "hard seed" which, because of the excessively hard seed coat, does not germinate the first season, although it is good in vitality and will grow the second year. The amount of seed sown per acre should vary according to the per cent that will grow the first season. If sixty per cent or more of the sweet clover will germinate readily, from ten to fifteen pounds of seed should be sown per acre. If unhulled seed is used the amount should be increased about five pounds per acre.

Rough, wooded, or stony lands that are untillable may be seeded by sowing the sweet clover broadcast during the late fall or winter. The seed will be worked into the soil by the alternate freezing and thawing of the ground or washed under by rains. On very sandy soils sweet clover is often drilled into the thin native sod by using a disk drill, as any other preparaion of the ground would make the seed bed too loose.

Threshing sweet clover seed.

INOCULATING.

Sweet clover, to produce satisfactory results, should be inoculated with the proper bacteria. If the crop is not growing along roadsides and in fence corners or anywhere else in the locality in which it is to be seeded, it is very likely that inoculating will be essential. This may be done by obtaining soil from an alfalfa field or ground on which sweet clover is growing and spreading it over the field which is to be seeded, at the rate of two hundred to three hundred pounds of inoculated soil to the acre. This should be harrowed in immediately, as exposure to the sunshine and the drying out of the soil will kill the bacteria. Best results will be obtained by applying the soil on a cloudy day. If inoculated soil is not available within reasonable distance it may be more practical to inoculate with the pure cultures that are sold for this purpose. This method consists of treating the seed with a pure culture of the proper kind of bacteria, according to directions accompanying the material. The inoculated seed should be sown soon after it is treated, and should never be exposed to the sun.

Fortunately the only portion of Kansas where it is necessary to inoculate for sweet clover is in those parts of the eastern fourth of the state where the crop is not growing naturally. The soil in the remainder of the state is evidently well supplied with the proper kind of bacteria.

HANDLING SWEET CLOVER FOR HAY.

Sweet clover properly handled produces a fair quality of hay which makes a desirable substitute for the more valuable kinds, such as alfalfa or red clover. One cutting of sweet clover can be obtained the first year. This crop should not be cut until the crown sprouts have begun to show on top of the roots about one inch underground. At this time the crop can be cut close to the ground. Two and perhaps three crops of hay may be obtained the second year. The first one should be cut just before the first bloom buds appear, since the plants rapidly become coarse and woody after they start to bloom. The sweet clover should be cut sufficiently high to leave a few branches and leaves on each plant. If cut too close at this time many of the plants will be killed. The second cutting should be handled in the same way as the first. The time of cutting will have to be governed by the

Cattle pasturing on sweet clover in Allen county, Kansas.

judgment of the farmer. The sweet clover will be continually in bloom soon after the second cutting comes on. Ordinarly it should be cut when about twenty inches high, and must be cut high, as at the first cutting. The third crop may be mowed close to the ground. The hay is cured in the same manner as alfalfa or red clover. More time is required to cure sweet clover hay than alfalfa or red clover because it is more succulent than the latter crops. If the weather is unfavorable at cutting, great difficulty is experienced in properly curing sweet clover hay. Also the tall stubble that it is necessary to leave in making the first cuttings interferes with the raking of the hay. For these reasons sweet clover will never be popular as a forage crop, except where other forage legumes can not be profitably grown.

SAVING THE SEED.

Where a seed crop is desired the second cutting of the second year's growth is the most practical one to leave, although maximum yields of seed can be obtained where the first cutting is allowed to grow to maturity. The sweet clover may be harvested readily with a binder, binding and shocking it like a small grain crop, or by cutting with a mower and raking and stacking similar to the way alfalfa grown for seed is handled. Along the Arkansas river in western Kansas, it is a common practice to head the sweet clover with an ordinary grain header. It is then put in medium-size shocks, usually placing one header-box load in each shock. This allows it to cure out readily and yet permits it to be shocked in a small space so that it can be brought rapidly to the thresher. Sweet clover should be cut about the time three-fourths of the seed pods become dark. Avoid handling the straw when in a very dry, brittle condition, as the seed will shatter badly at such times. The sweet clover should not be hulled or threshed until it is thoroughly dry. Yields of from two to eight bushels of seed per acre may be expected.

SWEET CLOVER AS A PASTURE CROP.

Sweet clover will undoubtedly prove of great value as a pasture crop throughout eastern Kansas, especially on lands to which it is adapted. It makes excellent pasture for cattle, sheep, horses, and hogs. It very rarely causes bloat and for this reason is preferable to alfalfa for pasturing cattle. Because of its vigorous growing habits, sweet clover will pasture, especially on the poorer types of soil, more stock per acre than most other pasture grasses or legumes. Sweet clover is about equal to alfalfa and red clover in feeding value, and stock pastured on it make gains that compare favorably with those secured on the latter crops.

Sweet clover can be used to a good advantage in supplementing other pasture. It produces early and late grazing, survives the midsummer droughts, often furnishing succulent pasture during the time regular pasture grasses are dormant, and will produce fairly well on soils that would otherwise be practically barren. Sweet clover may be grown along river bottoms, on land where the water does not stand, even though the water table occasionally rises within two feet of the surface of the soil. Because of this fact it is an important pasture crop on the low river bottoms not suited to alfalfa.

As a rule, live stock have to acquire a taste for sweet clover before they can be induced to eat it. The best way to accustom them to the crop is to pasture them upon it early in the spring, before other forms of green feed are available.

For best results the sweet clover should be pastured heavily enough to keep down the growth, so that at all times there will be an abundance of fresh shoots for grazing purposes. It may be necessary to clip back the old growth once during the second season to stimulate the development of fresh shoots. In case permanent pasture is desired sufficient plants should be left to thoroughly re-seed the field. If hogs are pastured on the sweet clover during the first year it is best to ring them to prevent them from digging up the roots of the young plants.

Maximum returns in pasturing sweet clover where the pasture enters into a rotation can be secured by maintaining two fields, one of which is seeded the year following the seeding of the other. Newly-seeded sweet clover will furnish pasture after it makes a growth of about twelve inches. Ordinarily it does not attain this height until some time in June in eastern Kansas and midsummer in the western part. The sweet clover can then be grazed for the remainder of the season if not pastured too heavily. The second year sweet clover makes a rapid early growth and will provide pasture from very early in the spring until the new seeding is available. The stock can then be transferred to the new field and the old field left

Cutting a seed crop of sweet clover.

for seed production or for hay, or it may be pastured alternately with the new field. By seeding a field to sweet clover every spring, this method of pasturing sweet clover may be continued indefinitely. Sweet clover pasture is available throughout the growing season and for a longer period than can be secured from most other pasture grasses.

SWEET CLOVER FOR SOIL IMPROVEMENT.

For quick results in improving the soil sweet clover is superior to most other crops. Its ability to thrive well on badly eroded soils, and on soils lacking in humus or otherwise badly run down makes it especially adapted for this purpose. Like alfalfa, cowpeas and other legumes, it has the ability to obtain nitrogen from the air by means of the nitrogen-gathering bacteria which live in tubercles on the roots of the plants. When plowed under for green manure or allowed to remain on the land this crop is a very efficient one in building up the humus and nitrogen content of the soil. The large roots, which penetrate deeply, break up the lower layers of the soil and add much humus to it when they decay, thus improving the physical condition of the soil some distance below the depth of plowing. Unproductive and heavy clay and hardpan soils may be so improved in texture and fertility by growing sweet clover on them for a few years that they become quite productive.

KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Experiment Station.

CIRCULAR NO. 45.

JANUARY, 1915.

DAIRY DEPARTMENT.

Dairy Farming.

O. E. REED.

ADVANTAGES OF DAIRYING.

A farm used for dairy purposes does not need to lose in fertility, but can gain, and may be used for dairying almost indefinitely. On a well-managed dairy farm practically all the feed grown is marketed through the cow. Concentrated protein feeding-stuffs, such as bran and oil meal, are usually purchased to balance the ration. These feeds contain a high percentage of fertilizing ingredients, and the manure from the cows consuming such feeds is very rich in plant food.

The first method of farming practiced in a newly settled country is grain farming. This is continued until the land becomes high priced and the fertility of the soil is decreased, when dairying usually comes into practice. In grain farming, the land is cropped year after year, and these crops are sold off the land. In live-stock or dairy farming, the crops are harvested and fed to the animals, and the income is obtained by selling the animals or their products.

Selling grain and other crops from the farm means selling soil fertility or plant food. No soil can grow crops year after year without sooner or later reaching the point where this depletion is felt. When animals and milk products are sold from the farm only a small portion of the plant food of the entire crop is sold. The greatest part of the plant food is left behind in the form of barnyard manure, and this may be returned to the soil. This is very clear when we compare the amount of plant food that is sold in milk and dairy products with that contained in the ordinary farm crops, as shown in the following table:

1 ton of butter contains	50 cents' worth of plant food.
1 ton of milk contains	$2.09 worth of plant food.
1 ton of wheat contains	$7.75 worth of plant food.
1 ton of oats contains	$7.26 worth of plant food.
1 ton of corn contains	$6.75 worth of plant food.
1 ton of clover hay contains	$9.07 worth of plant food.
1 ton of alfalfa contains	$9.50 worth of plant food.

In some of the eastern states of the United States land became so unproductive, as a result of grain farming, that the owners abandoned their farms. During the more recent years attention has been directed to these farms, and some of them are now yielding large crops. This change from an unproductive to a productive state has been brought about largely through the use of the dairy cow. On these farms hay and concentrated feeds have been purchased and fed, and in this way the fertility of other soils has been and is now being used to build them up. These same conditions exist in other countries. Much of Europe has gone through this period of soil depletion, and has taken up dairying, until now in Germany, Denmark and Holland, where cows are handled extensively, the land is producing larger crops than it did thirty years ago.

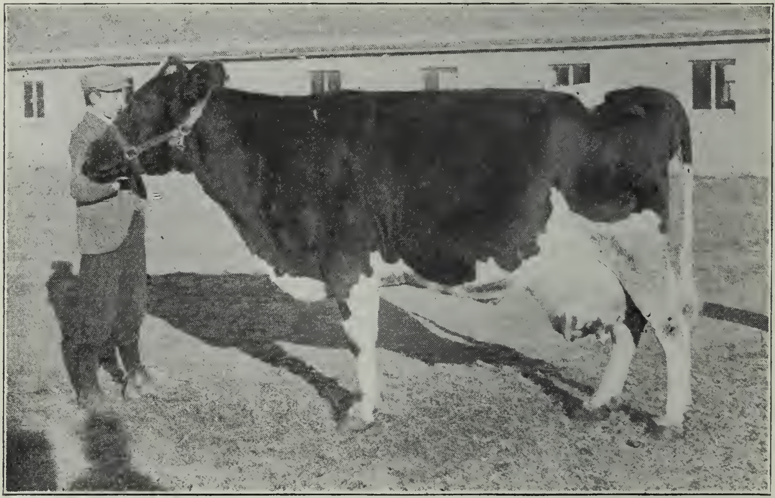

PLATE No. 1.—Maid Henry, Holstein cow, owned by the Kansas State Agricultural College. Record for one year, 19,600 pounds of milk, 837 pounds of butter.

In many parts of Kansas the soil contains a sufficient quantity of plant food, but it is so devoid of humus, or vegetable matter, that the plant food is not available. Soil lacking in vegetable matter will not retain water and packs and bakes after rains. Such a soil is called a poor soil. By rotation of crops, by marketing the crops grown through dairy cows or other live stock, and by using the manure, it is possible to add humus to the soil and thus to render it more productive.

The dairy cow is an economical producer of human food. No other animal can produce the same quantity of digestible food as economically as can the cow. The following table shows the comparative production of food of a cow and of a steer:

A Dairy Cow vs. a Steer as a Producer of Human Food.

	Yearly production of Maid Henry.	Prime steer,* weight 1250 lbs.
Proteids	686 lbs. solids.	172
Fat	716 " "	332
Sugar	932 " "	...
Ash	137 " "	43
Total	2,471	547

Maid Henry produced nearly five times as much total solids as did this prime two-year-old steer. The total solids produced by the cow are all edible, while the total solids of the carcass include the entire body, a great deal of which can not be used for food.

Because of this economy of production, the cow is adapted to high-priced lands and can utilize high-priced feed to advantage. That dairying is adapted to the high-priced land is shown by illustrations from European countries. Land on the Island of Jersey, which is the home of the Jersey cow, rents for from $50 to $80 per acre. Land in Holland is valued at $1000 per acre, and the chief agricultural pursuit is caring for and handling the Holstein cow and her products.

Dairying furnishes immediate and constant returns. A man with small capital can invest his money in a dairy cow and soon begin to realize on his investment. The prices of milk and butter fat are never subject to any great fluctuations, but are more steady and uniform than the price of many other commodities.

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* University of Missouri.

Keeping dairy cows on the farm furnishes employment the year round and in many sections this enables one to get the better class of farm labor. The best farm hands prefer to work during the entire year, and they can usually find work around the dairy.

THE DAIRY HERD.

The first essential for profitable dairying is good cows. The profitable dairy cow is one that will make the maximum production on the minimum quantity of food. The most profit can be made from special-purpose dairy cattle. A number of special dairy breeds have been developed by careful breeding and selection, covering periods of from 100 to 2000 years. Very often good milk cows are found among ordinary herds of scrub cattle, or among the beef breeds, but the great objection to such cows is that they do not always transmit their milking qualities to their offspring.

PLATE No. 2.—The Owl's Design, Jersey cow, owned by the Kansas State Agricultural College. Record for one year, 14,606 pounds of milk, 765 pounds of butter.

BREEDS OF DAIRY CATTLE.

The following named breeds are now classified as dairy cattle: Jerseys, Guernseys, Ayrshires, Holsteins, Brown Swiss, Dutch Belted and Milking Shorthorns.

Jerseys. The Jersey is, perhaps, the most popular breed of dairy cattle in the United States. More cattle of this breed have been registered than of any other. The Jersey is small in size. The cows weigh from 800 to 1000 pounds, when mature. The native home of this breed is Jersey Island, the largest in the group of the Channel Islands, lying between England and France. The majority of the animals are of solid yellow or gray-fawn color with a black nose, black tongue and switch of solid black. There are a great many broken-colored Jerseys, the bodies of which are some color of fawn with white spots. The milk of the Jersey is very rich in butter fat, the average test for the breed being about 5.2 per cent. It has a high color and is easily churned. The color and richness of her milk makes the Jersey a great favorite as a family cow. The cows of this breed are very economical producers of butter fat.

Plate No. 3.—Bernice Countess 2d, Guernsey cow, owned by the Kansas State Agricultural College. Record for one year, 9942 pounds of milk, 614 pounds of butter.

Guernseys. The Guernsey breed had its origin on the Island of Guernsey, the second largest island in the Channel Island group. Cows of this breed are somewhat larger than the Jerseys, averaging about 1000 pounds in live weight. The characteristics of the Guernsey are somewhat similar to those of the Jersey. In color the Guernsey may be either a solid lemon, orange fawn, or fawn with white markings, never gray or black. The nose is buff color, and the tongue and switch are generally white. The milk of this breed is not quite as rich as that of the Jersey, but there is a little more of it. The milk is especially noted for its extreme yellow color, and the butter made from it at any time of the year has a good yellow color. The average milk contains about 4.9 per cent butter fat.

Ayrshires. The native home of the Ayrshire is the county of Ayr, Scotland. The cattle of this breed are very strong and thrifty. They rank between the Jersey and Holstein in size. The cows average about 1000 pounds in live weight. In color they may be either a dark red and white or light red and white. The red color in the bulls often deepens into mahogany. The color of the Ayrshire gives her an advantage over the other breeds when fattened and sold for beef, as there is still a general prejudice among stock buyers against the dairy breeds for beef, especially against the Jerseys and Guernseys. In form the Ayrshire does not show the extreme angular dairy type exhibited by high-class Jerseys or Holsteins. They are somewhat smoother over the shoulders, back and hips, and show slightly more of the beef type, especially in the rear quarters. The Ayrshire cow is especially noted for her sym-

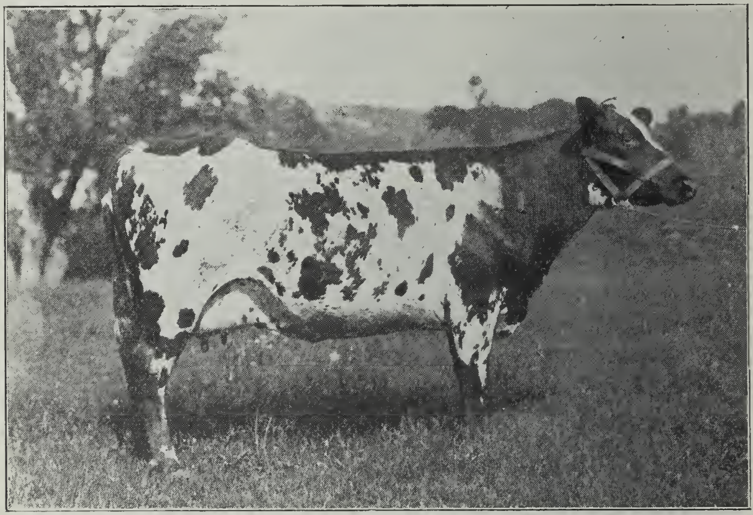


PLATE No. 4.—Elizabeth of Juneau, Ayrshire cow, owned by the Kansas State Agricultural College. Record for one year, 15,122 pounds of milk, 631 pounds of butter.

metrical udder. The milk has an average composition of 3.8 per cent butter fat, which adapts this breed to the production of market milk. These cattle are excellent rustlers, good breeders, and the calves are very strong and healthy.

Holsteins. This breed originated in Holland and has been bred in this region for at least two thousand years. During this time there has been very little if any mixing with outside blood. Since ancient times, Holland has been noted for its butter, cheese, and immense oxen. The Holsteins are the largest of the dairy-bred cattle. The average weight of the mature cow is 1200 pounds or more, but individual cows often weigh 1400 or more. The color markings are black and white. As a rule the breeders prefer animals on which the colors are evenly divided. The cows have good dispositions and are not easily frightened at any sudden disturbance.

As milk producers Holstein cows are unexcelled. They produce more milk and at a less cost per 100 pounds than any other breed. The milk is not very rich, averaging about 3.5 per cent butter fat. As beef producers this breed ranks high for a dairy breed. The calves are large at birth, grow rapidly, and make excellent veal. The Holstein is well adapted for supplying milk for cities or factories on account of the high yield and low average per cent of butter fat.

Brown Swiss. The Brown Swiss, as they are known in America, represent one of the leading breeds. It has been developed in Switzerland, and is probably one of the oldest breeds known. In its native land it is classed as a dual-purpose breed and formerly showed both as a beef and a dairy breed in America, but is now classed as a dairy breed. The cows weigh from 1200 to 1400 pounds and the bulls often weigh more than a ton. The color is brown to silver gray, resembling the color of some families in the Jersey breed. The cows give a good flow of milk, containing about 3.7 per cent of butter fat.

Dutch Belted. This oddly colored breed had its origin in North Holland and its development is considered a remarkable accomplishment in the way of breeding. In size the cattle rank with the Ayrshires but the general conformation is more like that of the Holstein. These cows weigh from 1000 to 1300 pounds. Their most distinctive characteristic is the presence of the white belt around the body. This belt extends around the body from just behind the shoulders to just in front of the hips. Cows of this breed are reputed to be fairly good milkers. The milk contains about 3.5 per cent of butter fat.

Milking Shorthorns. In the development of the Shorthorn breed several noted breeders placed considerable stress on the milking qualities of the animals kept in their herds. In this way several families of the breed have become famous as milk producers. An effort has been made by many breeders to develop a dual-purpose Shorthorn—one that would have superior dairy and beef qualities combined. So far very little has been accomplished. All Shorthorn cows producing large quantities of milk conform very closely to the dairy type shown by large breeds of dairy cattle. Their calves sell for a better price for beef than calves of the strictly dairy breeds, chiefly because of their color. It is very difficult to find any number of good Shorthorn milk cows that will transmit their milking qualities with any degree of certainty. A number of cows have made records of production of over 600 pounds of butter fat, but such cows are the exception rather than the rule. The Shorthorn cattle were developed in northeastern England, especially along the River Tees, and formerly were known as Tees Water cattle. The exact origin is not known but their development began early in the eighteenth century. In England to-day Shorthorns of the nonpedigreed type furnish a large per cent of the dairy products used. The milk of the Shorthorn contains from 3.5 to 4 per cent of butter fat and resembles the milk of the Holstein in color. Mature cows weigh from 1200 to 1400 pounds. The predominating color of this breed is red or red and white, but it may be roan or white.

BREEDS COMPARED.

In a comparison and classification of the four principal breeds of dairy cattle, they rank as follows:

With reference to amount of milk produced: Holstein, Aryshire, Guernsey, Jersey.

With reference to richness of milk produced: Jersey, Guernsey, Ayrshire, Holstein.

With reference to yellow color of milk: Guernsey, Jersey, Ayrshire, Holstein.

With reference to size: Holstein, Ayrshire, Guernsey, Jersey.

With reference to early maturing qualities: Jersey, Guernsey, Ayrshire, Holstein.

With reference to the amount of butter fat produced, there is very little difference between the breeds. There is more difference between individual cows of the same breed than between the breeds. Individual cows of the Jersey, Guernsey, Holstein, Ayrshire and Brown Swiss breeds have made over 1000 pounds of butter in one year.

Following is the name and yearly record of the cow holding the highest butter fat record of the breed she represents:

	Pounds milk.	Pounds fat.
Guernsey—May Rilma	19,673	1,073.4
Holstein—Banostine Bell DeKol	27,404.4	1,058.3
Jersey—Sophie 19th of Hood Farm	17,557	999
Ayrshire—Aucherbrain Brown Kate 4th	23,022	917.6
Brown Swiss—College Bravura 2d	19,460.6	798.2

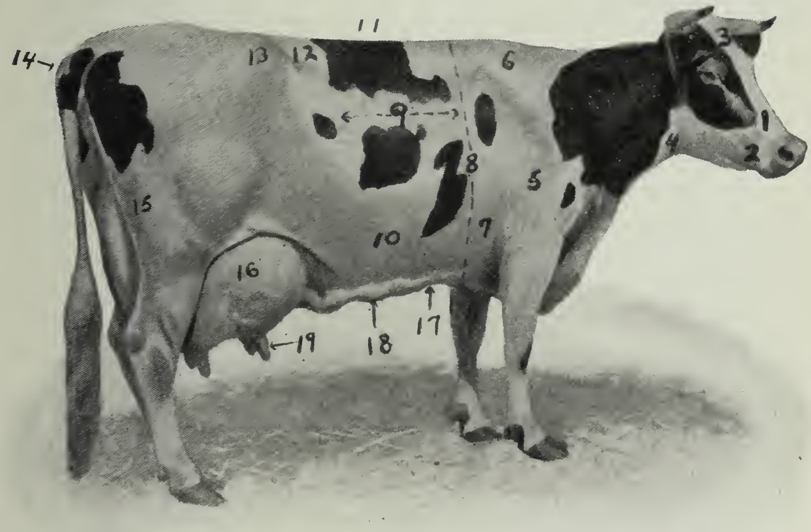


PLATE No. 5.—Location of points on cow.

1. Face.
2. Muzzle.
3. Forehead.
4. Neck.
5. Shoulder.
6. Withers.
7. Chest.
8. Heart girth.
9. Ribs.
10. Barrel.
11. Back.
12. Loin.
13. Hips.
14. Pin bones.
15. Thigh.
16. Udder.
17. Milk wells.
18. Milk veins.
19. Teats.

SELECTION OF THE DAIRY COW.

In starting a dairy herd the first thing to consider is the selection of the cows. There are two methods which can be used. The first is selection by conformation or type of the cow; the second is the selection of cows according to records of milk production. The first method is the one most generally used. The second method can not be followed very extensively, because only a small per cent of the cows have records.

SCALE OF POINTS FOR DAIRY CATTLE.

	Possible score.
GENERAL APPEARANCE, 18:	
1. *Form*—Inclined to be wedge-shaped	6
2. *Quality*—Hair fine, soft; skin mellow, loose, medium thickness; secretion yellow; bone clean, fine	6
3. *Temperament*—Nervous, indicated by lean appearance when in milk	6
HEAD AND NECK, 7:	
4. *Muzzle*—Clean cut; mouth large; nostrils large	1
5. *Eyes*—Large, bright, full, mild	1
6. *Face*—Lean, long; quiet expression	1
7. *Forehead*—Broad	1
8. *Ears*—Medium size, yellow inside, fine texture	1
9. *Horns*—Fine texture, waxy	1
10. *Neck*—Fine, medium length; throat clean; light dewlap	1
FORE QUARTERS, 5:	
11. *Withers*—Lean, thin	1
12. *Shoulders*—Light, oblique	2
13. *Legs*—Straight, short; shank fine	2
BODY, 26:	
14. *Chest*—Deep, low; girth large, with full fore flank	10
15. *Barrel*—Ribs broad, long, wide apart; large stomach	10
16. *Back*—Lean, straight, open-jointed	2
17. *Loin*—Broad	2
18. *Navel*—Large	2
HIND QUARTERS, 44:	
19. *Hips*—Far apart, level	2
20. *Rump*—Long, wide	2
21. *Pin Bones or Thurls*—High, wide apart	1
22. *Tail*—Long, slim; fine hair in switch	1
23. *Thighs*—Thin, long	4
24. *Udder*—Long, attached high and full behind, extending far in front and full, flexible; quarters even and free from fleshiness	22
25. *Teats*—Large, evenly placed	5
26. *Mammary Veins*—Large, long, tortuous, branched, with double extensions; large and numerous milk wells	5
27. *Legs*—Sraight; shank fine	2
Total	100

Selection by Type or Conformation. There is no doubt that there is a certain type or form that is associated with large milk production, and in conformation the dairy cow is quite the opposite of the beef animal. The dairy cow is angular, spare in flesh, and is usually referred to as being wedge-shaped, while the beef animal has a square, blocky form. The score card given below may be used somewhat as a guide in selecting cows. It shows the relative importance of the different parts of the body.

General Appearance of the Cow. The first impression one gets when viewing a high-producing cow, or a photograph of a high producer, is the marked angularity and thin, loose-jointed, appearance. The thin appearance is not a condition caused by lack of feed, but the animal is well-muscled and neat, with the hair and skin in good, healthy condition. The angular conformation is best described by the term wedge-shaped. The dairy cow has three wedges. A wedge is noticed when the cow is viewed from the front, from the side, and also from above. The first wedge mentioned is formed by the withers being sharp at the top and the chest being wide at the base. The depth through the rear part of the barrel and udder tapering to the neck and head forms the wedge as viewed from the side. The wedge, as seen from above, is formed by the extreme width through the hips gradually tapering to the sharp withers. The wedge shape is not extremely pronounced in all dairy cows but is usually found in the best animals.

Quality. The dairy cow should have plenty of quality. High production of milk and butter fat is associated with this characteristic. Quality is indicated by fine hair, soft, loose, mellow skin of medium thickness, and a fine, clean bone. Dairy temperament is another essential. By this is meant the ability to convert the feed into milk, and it is indicated by a good nervous sysem well under control. A cow may have a good nervous system, yet not have the dairy temperament, on account of the nervous system not being under control. A good nervous system is indicated by a neat, refined appearance, spareness in flesh when in milk, and a large, full, mild eye. The dairy cow should be healthy and in good condition; should be spare in flesh while in milk; but may be allowed to carry considerable flesh when not giving milk.

The Head. The head should be clean cut, of medium length, quiet expression, and of feminine appearance. The eye should be large, bright and full. A mild expression in the eyes indicates a good disposition. The forehead should be slightly dished and broad. The jaw should be strong and wide, tapering somewhat to a strong, broad muzzle. A good-sized muzzle and strong jaw are indications of a good feeder. The ears should be of medium length, good texture and fine quality, with an abundance of orange or yellow color inside. This color is believed to indicate the richness of the milk. The neck of the cow should be moderately long, thin and muscular, with clean throat and light dewlap. The neck of the typical dairy cow does not join the body as neatly as does the neck of the beef animal, but is long, lean and free from fleshiness.

Body. The heart girth should be large, indicating lung and heart capacity. The back should be long, strong and loose jointed, but not necessariy straight. The ribs should be long, wide and far apart. The abdomen or barrel should be long, wide and deep, especially just in front of the udder. A cow must have capacity of barrel to be able to handle large amounts of food. Often a cow will not show a great depth of barrel but may have a large capacity for food by having a greater width of barrel and wide spring of ribs. A strong jaw, keen eye, large muzzle and capacious barrel are the indications of ability to consume and digest large quantities of food, which is necessary for high production. The loin should be broad and strong, with roomy coupling.

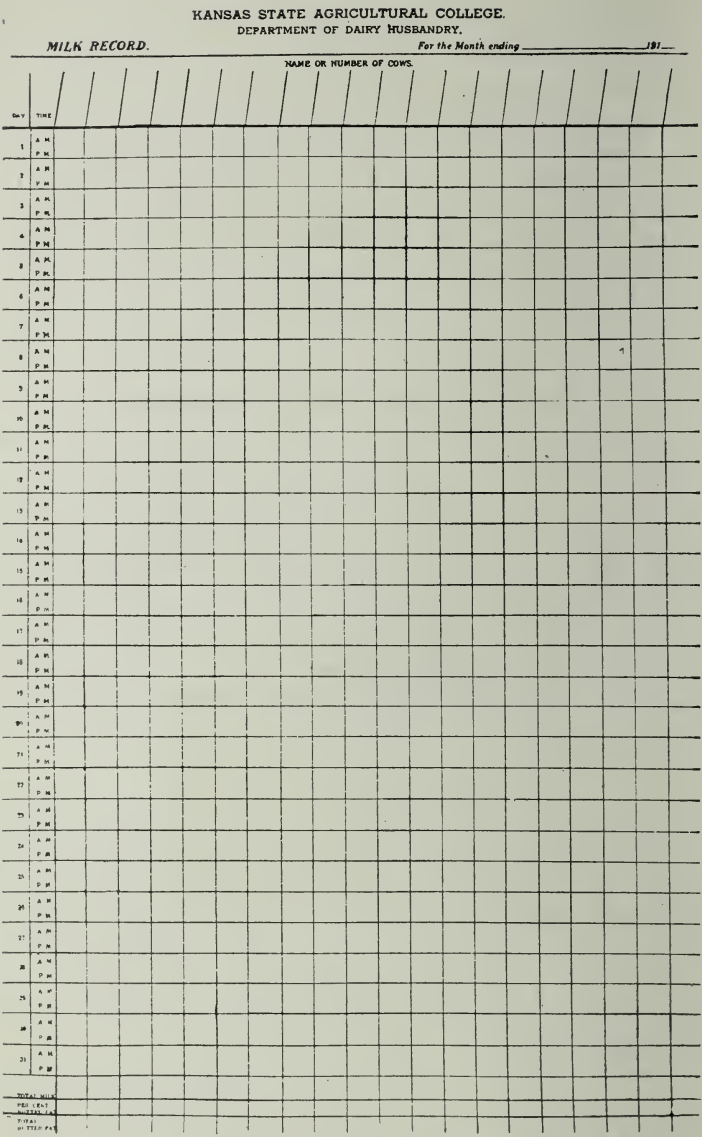
Hind Quarters. The hind quarters should show the leanness characteristic of other parts of the body. The hips should be far apart, prominent and level with the back. The rump should be long and wide with a roomy pelvis; the pin bones high and wide apart. Such a conformation of this region affords plenty of room for the generative organs and reproduction. The thighs should be long, thin and wide apart, with plenty of room for the udder. The legs should be fine, straight and far apart.

Udder. The udder of the cow is one of the most essential organs, and is largely used as a determining factor of the ability of the cow as a producer. The udder should be capacious, free from flesh and when empty should be soft and flexible. Capacity of the udder should be gained by length and width rather than depth. It should be attached to the body high behind and far forward toward the naval and show plenty of width throughout. This conformation permits of more surface for the blood vessels to spread over as they pass through the udder. The udder is the milk factory, where the nutrients are taken from the blood and made over into milk. By some unknown process, in the udder the food materials taken from the blood are changed to the substances found in the milk. The milk veins serve as an index to the amount of blood that flows through the udder. These veins carry the blood from the udder back to the heart. They can be noticed leading from the four quarters of the udder and running forward just underneath the skin and entering the abdomen near the center of the body. The milk wells, through which the milk veins enter the body, should be large. There may be more than one milk well on each side of the body. In some cases, the milk veins branch as they leave the udder and enter the body in several places. Cows have been known to have as many as five milk wells on each side, and it is not uncommon to find cows with two or three milk wells on each side of the body. The quarters of the udder should be even in size and not cut up; but the base or sole of the udder should be flat. The teats should be even, of good size for milking conveniently, and set squarely on each quarter of the udder. The hair on the udder should be fine and soft, indicating quality.

KEEPING RECORDS OF THE COWS.

After one has a herd there is no excuse for not knowing the records of each animal in it, for this is the only sure way of selecting profitable cows. A cow may score very high, according to the score card, and still not be a very profitable producer. By selecting cows on their records, discarding the unprofitable ones, using good sires and raising heifer calves from the best cows, one is sure to increase the productiveness of the herd.

In keeping records of the cows one must consider the disposition made of the milk and keep the records necessary to figure the profits or the loss of the product sold. One who sells milk, either wholesale or retail, regardless of the fat content, need only keep a record of the amount of milk produced and feed consumed. When the product is sold as



KANSAS STATE AGRICULTURAL COLLEGE.
DEPARTMENT OF DAIRY HUSBANDRY.

MILK RECORD. *For the Month ending ________________191__*

DAY	TIME	NAME OR NUMBER OF COWS.																			
1	A M																				
	P M																				
2	A M																				
	P M																				
3	A M																				
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4	A M																				
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29	A M																				
	P M																				
30	A M																				
	P M																				
31	A M																				
	P M																				
TOTAL MILK																					
PER CENT BUTTER FAT																					
TOTAL BUTTER FAT																					

Plate No. 6.—Milk record chart.

cream and payment made on a butter-fat basis, or where butter is sold, a record should be kept of the butter-fat production.

The best method to follow in keeping such a record is to weigh the milk at each milking and test the milk at regular intervals with the Babcock tester. In this way the actual record of each cow's production can be ascertained. This information will also be of value in the feeding of the herd.

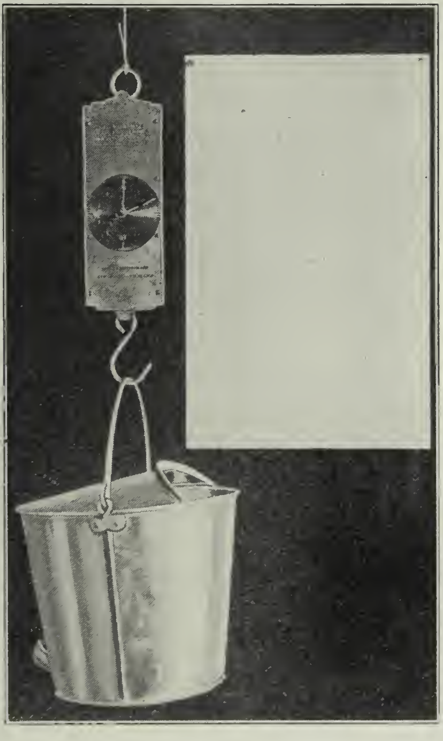

Plate No. 7.—Complete outfit for keeping milk records.

Milk record sheets may be obtained by writing the Dairy Department, Kansas State Agricultural College. Babcock testing outfit may be obtained from any firm handling dairy supplies.

It is not practical to make a butter-fat test of each milking; testing the milk for several milkings once a month will be sufficient. The fat content does not vary as much as the quantity of the milk. A composite sample, representing the milk given during two days, will give very accurate results.

The per cent of fat obtained from this sample multiplied by the pounds of milk given during the month will give the estimated butter-fat record for the month. The method of testing milk for butter fat is given on page 24.

When butter fat is sold from the farm each cow's production of butter can be estimated by keeping the butter-fat record and then increasing the amount of fat by one-fifth. Average butter contains about 83 per cent of butter fat.

The advantage and value of having a record of the cows in the herd is shown by the results of the Dickinson County Cow-Testing Association for the past year. (See Experiment Station Circular No. 35.)

The following tables give the records of the ten best and the ten poorest cows in the association:

TABLE 1. *Record of the Ten Best Cows.*

Months milked.	Milk.	Fat.	Value of products.	Cost of feed.	Profit.	Return for $1 in feed.
11	13,689	546	$201.12	$55.91	$145.21	$3.60
12	8,094	449	152.58	49.00	103.58	3.11
11	10,258	386	144.44	50.35	94.09	2.67
11	7,229	384	131.90	48.49	83.41	2.72
10	8,191	377	133.92	26.16	107.76	5.12
11	7,290	376	130.00	49.89	80.11	2.61
9	8,042	375	131.77	37.42	94.35	3.52
11	7,926	372	131.50	37.17	94.33	3.54
10	6,573	368	124.86	41.30	83.56	3.02
10	6,973	365	125.70	47.77	77.93	2.81
Average	8,427	400	$140.78	$44.35	$96.43	$3.11

Butter fat valued at 28 cents per pound and skim milk at 40 cents per hundred.

Profit is the difference between value of butter fat and skim milk, less cost of feed. The manure and calf are liberal offset for other items of expense.

TABLE 2. *Record of Ten Poorest Cows.*

Months milked.	Milk.	Fat.	Value of products.	Cost of feed.	Profit.	Loss.	Return for $1 in feed.
5	1,418	59	$21.58	$33.23	......	$11.65	$0.65
7	1,260	66	22.83	25.11	......	2.28	.91
7	2,796	117	42.49	27.35	$15.14	......	1.63
10	3,405	121	46.16	30.15	16.01	......	1.53
9	3,102	125	45.89	26.63	19.26	......	1.72
7	2,784	125	44.62	35.47	9.15	......	1.26
7	3,801	138	52.25	22.14	30.11	......	2.36
8	3,222	142	50.95	27.25	23.70	......	1.87
8	4,102	149	56.04	34.73	21.31	......	1.61
12	3,534	148	53.92	22.32	31.60	......	2.86
Average	2,942	119	$43.67	$28.44	$15.23		$1.54

The best cow produced 546 pounds of butter fat in a year, and made an average return of $3.60 for each dollar's worth of food consumed. The poorest cow produced only 59 pounds of butter a year and made a return of only 65 cents for each dollar's worth of food consumed. The ten best cows made an average production of 400 pounds of butter fat and an average return of $3.11 for one dollar invested in feed. The ten poorest made an average production of 119 pounds of fat and the return for one dollar's worth of food was $1.54. A herd of 10 cows such as the best cows in this association would return the owner a yearly profit of $964.30, while a herd of 10 cows such as the poorest ten in the association would require the same amount of the owner's attention for a year and return a profit of only $152.30.

The man who owned the best cow, as well as the man who owned the poorest cow, did not realize that he had such animals in his herd. All the good cows were not found in one herd, but there were poor cows as well as good ones in all the herds. This condition is undoubtedly the same as is found in the average herds of the state. The only way that one can detect just how much difference there is between the cows in a herd is to keep records of their production.

THE SELECTION OF THE HERD SIRE.

The future development of the herd depends to a great extent upon the kind of sire used with the herd. It has been said that the sire is half the herd, and it is a fact that all future cows in the herd carry 50 per cent of his breeding.

The herd sire should be a pure bred of the breed he represents and be backed by good ancestry. If possible he should be a sire whose mother and other close female ancestry have shown high records of production. A yearly record is to be preferred to one of shorter duration.

If it is not possible to know the record of production one should by all means see the mother of the animal in question and note how closely she conforms to the dairy type. If the sire's father has daughters that have proven to be good producers he is more certain to transmit the dairy qualities desired. Very often it is possible to buy an old sire who has proven to be a good breeder. Good results from the use of such an animal are almost certain. The objection to buying an old bull is that he is high priced, if his value is known, and one runs a chance of getting an unruly animal. A bull calf is usually selected. A calf can be purchased for less money and the owner can train him as he chooses. Too much attention can not be given to the selection of a sire, for future successes depends largely upon the head of the herd.

FEEDING THE DAIRY HERD.

In order to reap the highest and most economical returns from a properly bred and selected herd, the animals must be fed intelligently. One of the principal reasons for the low average production of the Kansas cow is that she is not properly fed. By weeding out the poor cows and feeding the best ones more intelligently it would easily be possible to double the production of the cows of the state.

If the cows are to make their maximum production it is essential that they be properly fed and cared for before they freshen. Each cow should be given four to six weeks rest each year. During the time the cow is dry she must be well cared for, and not turned out on a poor pasture or stalk field to care for herself. The cow needs this rest in order to repair and build up her body. At the same time there is a great demand for food to develop the unborn calf. Hence it is necessary for her to have plenty of food to meet these requirements. She should also be allowed to gain in weight. The cow that freshens poor in flesh can not be expected to milk well during the following milking period. But the cow that is in good flesh when she freshens will start off giving a large flow of milk and will keep it up for a long time.

For several days, or a week, before the cow is due to freshen her grain should consist of bran. The bran will act as a laxative and thus the digestive system of the cow will be brought into good condition before calving. Immediately after she freshens the cow does not need, and should not be fed, a heavy grain ration. A ration of bran, fed dry or as a mash, is sufficient for several days. If the cow has surplus flesh at this time she will draw on the store and produce a large amount of milk from the start. The cow should be given a small quantity of grain at first, this being gradually increased as the milk flow increases. After all swelling and inflammation is gone from her udder she may be given a heavier grain ration. At the end of three or four weeks, she will reach her maximum milk production, and should then be on full feed. From this time on the ration should be regulated according to the quantity of milk given.

The ration given the cow will depend upon the kinds of feed available. This will vary according to location. Thus a general discussion of the feeding question is necessary.

MAINTAINING SUMMER CONDITIONS.

Economic feeding resolves itself into a study and execution of the lesson which Nature teaches. Under natural conditions the average cow makes her greatest production in milk during May and June, or early summer. When she is turned to pasture in the spring, after having received a dry ration, she will invariably increase in milk flow. The ration the cow receives at this time is Nature's ration, grass in its choicest form. There is plenty of food at hand, it is palatable, succulent, easily digested and contains plenty of food nutrients, and the cow is comfortable. The intelligent feeder, therefore, will strive to maintain these conditions as nearly as possible throughout the year.

While the average cow does her best on pasture and receives sufficient nutrients at that time, the high producer will require additional feed while on pasture and should be given all the grain for which she will make returns. A high producing cow on pasture will for a time make up the deficiency by drawing on her body for the necessary nutrients required, but she will soon exhaust this supply and will then decline in milk production. As the season advances the pastures dry up or get short, and they should then be supplemented with other feeds. Silage or green crops such as corn, alfalfa, oats and peas, may be fed at that time. Perhaps that is the most critical time in the milking period of the average cow. The majority of cows in the state freshen in the spring and when the pastures are not supplemented they decline very rapidly in milk production or "go dry" entirely.

BALANCED RATION.

As winter approaches the conditions prevailing in early summer must be provided for by the feeder. The food supply should be plentiful and be so combined as to make the ration a balanced one. It is highly essential that the cow owner know something of the composition of the various feeds and know how to combine these feeds in a ration to get the best results.

There are three substances which must be considered in making up the ration of the dairy cow. These substances are contained in almost all feeding stuffs to a greater or less extent. They are protein, carbohydrates and fat. Some feeds contain a high per cent of one of these substances and other feeds contain a high per cent of another substance. The protein or nitrogenous substance is the most expensive of the three. It is used by the animal in the production of hair, hoof, hide, horn, blood and muscle. Such feeds as alfalfa, cowpea and clover hay, cottonseed and linseed meal, bran, oats and gluten feeds, contain a high per cent of this substance. The carbohydrates (sugar and starches), and fat are used for the same purpose and may be classed together. These substances are used by the animal to produce heat to keep the body warm, to furnish energy and to make the fat that is stored up in the body and in the milk. Such feeds as corn, cane, kafir and corn silage, timothy hay, corn, cane, kafir and corn fodder, millet, oat and wheat straw, all contain a high per cent of carbohydrates. All of the feeds mentioned in both groups contain some fat.

A balanced ration must contain both protein and carbohydrate foods. In sections of the state where alfalfa, clover, peas or other legumes can be successfully grown for hay they should be depended upon to furnish the protein in the ration, and since the protein is furnished in the roughage it is best to feed a grain ration that is rich in carbohydrates in order to balance the ration. Thus if alfalfa hay is available for roughage, corn is the logical grain ration. Where legumes can not be grown the roughages usually are depended upon to furnish the carbohydrates, and under this condition the grain ration should be made up of some food rich in protein. If the roughage consists of cane or kafir hay or fodder, or prairie hay, the grain ration should be made up of such feeds as bran, oil meal, oats, etc. The protein feeds are the most expensive feeds on the market; hence a cheaper dairy ration can be obtained in localities where the protein is produced in such home-grown feeds as alfalfa, pea and clover hay.

COWS MUST BE FED AS INDIVIDUALS.

To feed cows economically they must be fed as individuals and not as a herd. It is often the case that cows in a herd are all fed the same quantity, regardless of the quantity of milk produced. By such a practice some cows are overfed, while others are underfed.

In feeding animals it should be understood that the animal uses a certain amount of the food it receives to maintain the body. This is called food of maintenance and it is the first use to which the animal puts its food, whether producing milk or not. The feed given in excess of this amount is used for producing milk, storing fat on the body, or for growth in the case of the young animal.

Of the two common mistakes in feeding, perhaps underfeeding is the most common. It is a poor practice and a serious mistake to feed a cow only the amount required to maintain her body and to deprive her of sufficient additional feed to produce all the milk she is capable of producing. The effect of underfeeding may not be noticed at once, as a cow will produce milk for a time at the expense of her body. That is, she will take the surplus flesh off her body and convert it into milk. Hence, if a cow declines in weight, while producing milk it shows that she is not receiving enough feed. In the case of a cow being overfed, it may be detected in a short time by the fact that she will put fat on her body, or she may get off-feed.

SILAGE NECESSARY.

Another condition of the early summer ration, which should be maintained or imitated during the winter, is that of feeding a succulent ration. By the term succulent feed is meant feed having that property possessed by green grass. Such a feed has a value in addition to the nutrients it furnishes. It serves to keep the digestive organs in good condition. This succulence may be secured in the winter ration by feeding silage or roots. Where roots can be grown successfully they serve the purpose well. In this state silage is the cheapest succulent feed, because it is possible to obtain large yields of corn, cane or kafir and such feeds make excellent silage. Aside from supplying an excellent feed, the silo furnishes a means of handling the whole forage plant in the most convenient and best way possible.

The main object in formulating a ration, after selecting the feeds to be used, is to provide a sufficient bulk at all times to satisfy the appetite and feeding capacity of the animal and to furnish the amount of nutrients needed for the work the cow is doing. If the ration lacks bulk the cow will be discontented. An animal may be fed enough nutrients in the form of grain to perform her work, but may receive too little of bulk to be satisfied. The roughage should form the foundation of the dairy ration. A cow should have all the roughage she can clean up at all times and the grain ration should be regulated by the amount of milk produced. A cow giving rich milk should be fed one pound of grain to each three pounds of milk produced per day, while for a cow giving less rich milk, such as a Holstein, one pound of grain to four pounds of milk is sufficient.

As the winter feeding period comes on the animal's comfort should be considered. Shelter and clean quarters should be provided. A cow will respond readily to warm and comfortable stables, well lighted and properly ventilated. If exposed to cold, a large portion of the feed ration which otherwise would be turned into milk goes to supply the necessary warmth. This makes economic feeding impossible, since the feed of the dairy cow is expensive fuel.

SOME RATIONS.

The following rations contain enough nutrients for a cow weighing 1000 pounds and producing 25 pounds of 4 per cent milk daily. If a cow gives more or less than 25 pounds, mix the grain in the same proportion as given and feed in proportion to amount of milk produced. Cowpea hay may be replaced by alfalfa, clover, or soy-bean hay. Corn may be replaced with kafir. Linseed meal may be replaced by cottonseed meal or gluten meal. Silage is considered a roughage, and when added to any of the rations, three pounds of silage in bulk is equivalent to one pound of hay. Silage made from kafir, cane or other sorghums is almost equivalent to corn silage .

	Pounds.
Alfalfa	12
Silage	35
Corn chop	4
Bran	2
Linseed meal	1
Timothy hay	18
Barley (ground)	5
Linseed meal	3
Alfalfa hay	18
Corn-and-cob meal	5
Cottonseed meal	2
Clover hay	12
Corn stover	5
Corn chop	5
Linseed meal	2
Sorghum fodder	15
Wheat bran	5
Kafir corn	5
Linseed meal	2

	Pounds.
Prairie hay	18
Wheat bran	5
Wheat shorts	5
Cow-pea hay	18
Corn chop	5
Linseed meal	2
Prairie hay	18
Oats (ground)	5
Linseed meal	2
Clover hay	8
Timothy hay	8
Sugar beets	20
Corn chop	4
Oats (ground)	3
Alfalfa hay	10
Dried beet pulp	5
Corn chop	4
Gluten feed	1

THE DAIRY BARN.

A cow will not produce the maximum flow of milk unless she is comfortable. The barn does not need to be expensive but must provide a comfortable tie, a substantial floor that can be kept clean, and plenty of fresh air and sunlight, and it should be warm enough for comfort in severe weather.

There must be plenty of windows to admit fresh air and sunlight. A dark barn affords an ideal place for the growth of bacteria. Sunlight is the greatest enemy of bacteria and it does not cost much. A barn must be ventilated by dropping the windows in from the top, or by a system of ventilation, such as the King System, can be installed for this purpose.

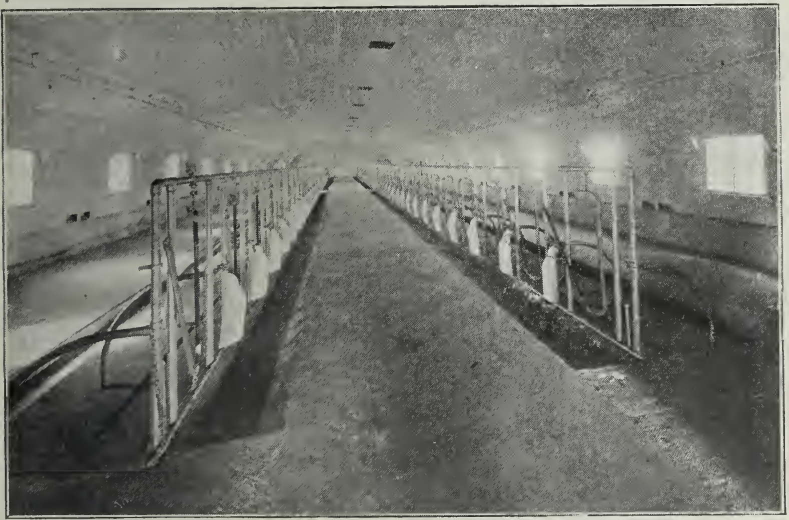

PLATE No. 8.—Interior view of dairy barn at the Kansas State Agricultural College.

The stalls should be adjusted to the size of the cows. For Holsteins, or other large cows, the stalls should be at least three and one-half feet wide, and five feet long, measured from the stanchion to the manure gutter. For cows of the size of the Jersey, the stall should be three feet wide and four and one-half feet long. It is advisable to make the platform wider at one end than at the other, so that the largest cows may be accommodated at the wider end and the smaller cows at the other. When the platform is accurately adjusted to the size of the cow it is much easier to keep the cows clean. The manger should be at least two and one-half feet wide and the manure gutter at least sixteen inches wide and from six to ten inches deep.

The floor of a barn may be made from almost any building material, but a cement floor will give more general satisfaction than will any other, because it is more durable and easier to keep clean. Objection is raised to a cement floor because of its coldness, and some claim that the cow's knees are injured because of the hardness of the cement. If plenty of bedding is used these objections are easily overcome. In cold climates, or where bedding is scarce and expensive, a wooden platform can be built over the cement floor to protect the cows. The cement floors on which the cows are expected to walk should be made rough to prevent the animals from slippng and falling. Too often the floors are made smooth for the reason that they are easier to keep clean, but the cow's comfort and safety should have first consideration.

DIRECTIONS FOR MAKING THE BABCOCK TEST.

Apparatus: 17.6 cc. pipette, 17.5 cc. acid measure, test bottles, dividers, water bath, centrifuge, and sulphuric acid, specific gravity 1.83 to 1.84. The milk to be tested and the acid used should be brought to a temperature of about 70 degrees; this can best be done by the use of the hot-water bath.

1. Pour sample of milk to be tested from one vessel to another at least five times.

2. Take pipette between thumb and second and third fingers, leaving the index finger free. Draw milk into pipette immediately after stirring, and place the index finger over the top of the pipette; now release the finger very slightly until top of the milk column is even with the mark on the pipette.

3. Hold milk bottle on a slant and place end of pipette in the neck of bottle, leaving an opening for air, so that air bubbles can not form and throw milk out of neck, and release finger and allow the milk to flow into the bottle, blowing the last drop from the pipette.

4. Fill acid measure to mark (*never draw acid into pipette*), take milk bottle by the neck between thumb and fingers of the left hand, so that the bottle can be turned; now bring the

lip of acid measure to mouth of bottle, and pour acid into the bottle, rotating the bottle so that all of the milk will be washed from the neck into the bottle. Hold the bottle at a slant so that the acid will not fall directly on the milk and form pieces of charred curd.

5. Give bottle a rotary motion in order to cause a gradual mixing of milk and acid; sudden mixing will cause large amounts of heat and gas and will throw the material out of the bottle.

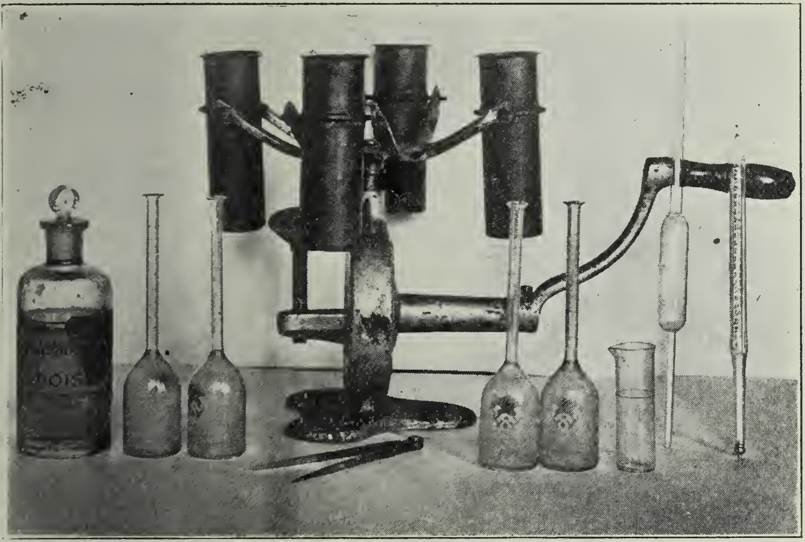

Plate No. 9.—Babcock testing outfit.

6. After the bottle has been stirred thoroughly and the curd is dissolved, place the bottle in centrifuge and whirl five minutes. ·

7. Place bottles in water bath of 180° F. for five minutes and fill with hot water to neck.

8. Whirl for two minutes.

9. Place in water bath for five minutes and fill with hot water to within one-half inch of the top of bottle.

10. Whirl for two minutes.

11. Place in water bath, 130° F., for five minutes.

12. Measure fat column by placing one point of dividers at bottom and the other at the top; then, keeping dividers at

that spread, place one point on the zero mark and note where the other point falls on the scale. That number will correspond to the per cent of fat in the milk.

NOTE.—In testing cream, regular cream-test bottles must be used, and the samples of cream for testing should be weighed instead of being measured. Only sufficient acid is used to dissolve the milk solids. In reading the cream test read from lower edge of fat column to a point that includes one-half of meniscus.

KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Experiment Station.

CIRCULAR NO. 46.

DEPARTMENT OF ENTOMOLOGY.

The Spring Canker-worm Situation in Kansas.

GEO. A. DEAN.

The injuries sustained in Kansas by the ravages of the spring canker-worm have extended over a period of several years. Last year this injury was very serious. For instance, the spring canker-worm killed more apple trees in Kansas in a single season than the San José scale has killed during its entire history as a pest in the state.

The injury done by the canker-worm is not confined to fruit trees; it also attacks a number of our most valuable forest and shade trees. Last spring the elms over a large portion of the state were partly, and in many cases completely, defoliated by the spring canker-worm. The injury caused by this insect, together with the dry, hot weather which followed the attack, killed a large number of elms. Many of the trees that were not killed were weakened, and thus rendered susceptible to the attack of wood borers. Yet, notwithstanding this great loss to orchards and shade trees, many fail to realize the importance of combating the insect until it has done a large part of its destructive work. The canker-worms are almost certain to prove serious during the coming season, and unless every effort is made to prevent them from injuring the trees, the danger will assume large proportions.

DESCRIPTION OF THE CATERPILLARS AND MOTHS.

The spring canker-worm is among the most common of the "loopers" or "measuring worms." The full-grown caterpillar is from three-quarters to an inch and a quarter long, slender, naked, and cylindrical. (Fig. 1.) The color varies, but the predominating color is dark greenish-olive or blackish, marked with narrow pale lines down the back and a whitish stripe along each side. If disturbed on the branch it will drop suddenly, suspended by a fine silken cord.

The wings of the male moth expand a little more than an inch. The front wings are semitransparent, brownish-gray in color, with three rather indistinct dark lines across them. (Fig. 2.) The hind wings are of a pale ash color, much lighter than the front ones. The females are wingless, and at the first glance look much more like spiders than moths. (Fig. 3.) They are about one-third of an inch long, of a dull brownish or grayish color, with a dark stripe down the middle of the back.

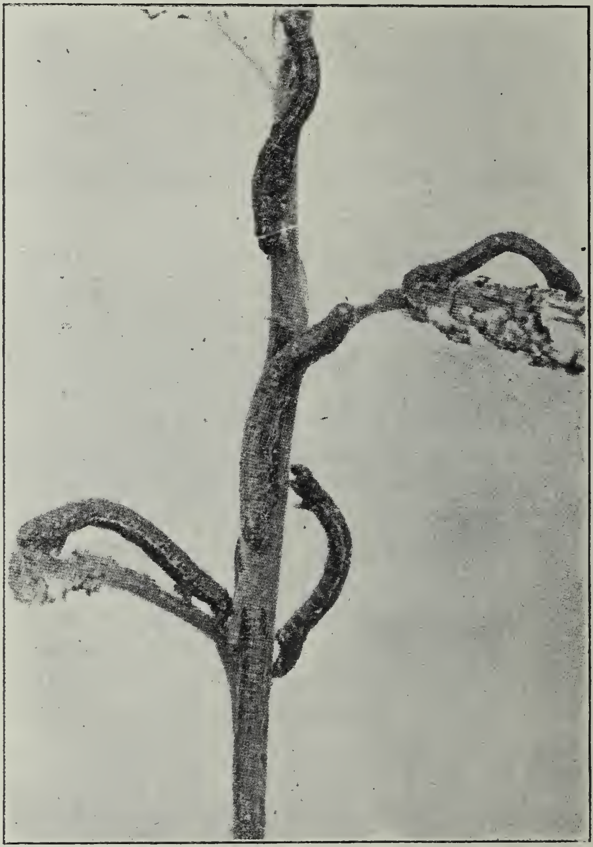

FIGURE 1.—Full-grown spring canker-worms. One and one-half times natural size. (After Slingerland and Crosby.)

HABITS AND LIFE HISTORY.

While several of the male and a few of the female moths emerge during the fall and winter months, the great majority emerge in early spring from pupæ, in which stage they pass the winter from two to five inches beneath the surface of the ground. Sometimes many of the moths emerge during a warm spell in February, but it is usually in March that the principal emergence takes place. The wingless, grub-like females crawl up the trees and deposit their oval-shaped, yellowish eggs in irregular clusters, or masses, on the branches. (Fig. 4.) The eggs are usually placed in sheltered places formed by fruit spurs and leaf scars, or they are concealed beneath pieces of loose bark or at the base of large branches. A single female

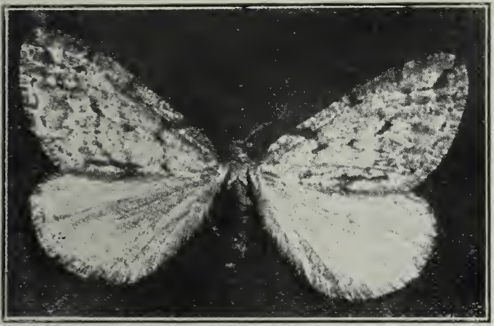

FIGURE 2.—Spring canker-worm, male moth. Two times natural size. (After Slingerland and Crosby.)

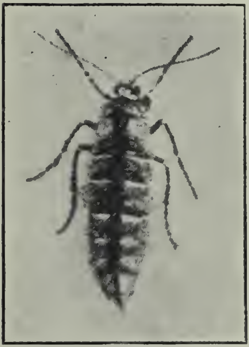

FIGURE 3.—Spring canker-worm, female moth. Two times natural size. (After Slingerland and Crosby.)

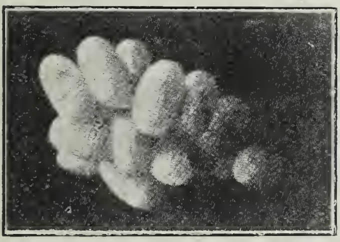

FIGURE 4.—Eggs of the spring canker-worm. Enlarged. (After Slingerland and Crosby.)

moth may lay over four hundred eggs. They hatch about the time the apple tree unfolds its leaves, or about the time it is in full bloom, and the young worms greedily devour the blossoms, leaves, and the setting fruit. They grow rapidly and feed ravenously, and when abundant will completely defoliate orchards and shade trees in a few days. Usually they reach their full size in from three to four weeks after hatching, and then pass to the ground, either by crawling down the trunk of the tree or by lowering themselves by the silken threads. They enter the ground, transform to pupæ, and remain here until the first warm days of the spring or late winter. There is only one generation produced each year.

METHODS OF CONTROL.

Cultivation. After the worms have entered the ground to pupate just beneath the surface, large numbers may be destroyed by thorough cultivation of the orchard. This should be done during the summer and early fall.

Spraying. The caterpillars may be quickly destroyed by spraying with arsenate of lead, using from two to three pounds to fifty gallons of water. The first spraying should be done as soon as the foliage is partly expanded and before the trees bloom, and the second spraying should be given as soon as the blossoms fall. In other words, if the apple trees are thoroughly sprayed for the control of the curculio and the codling moth they are never seriously injured by the cankerworm. Usually the first spray (also called the cluster-cup spray) is the more important, as the young caterpillars are much more easily killed.

Banding. Where, for any reason, spraying is not feasible, and in the case of shade trees or of a few fruit trees, a simple method, and one that gives excellent satisfaction, consists of banding the trunk of the tree with a sticky substance to prevent the ascent of the wingless females. The best method is to smear the sticky substance on bands of heavy paper, such as building paper or tarred paper, bound to the trunk of the tree. The paper bands should be about six inches wide and the sticky substance should be smeared in the middle of it. The bands should be put on during the first warm days of early spring, and the sticky substance renewed whenever the material hardens. Either cotton should be stuffed behind the band to

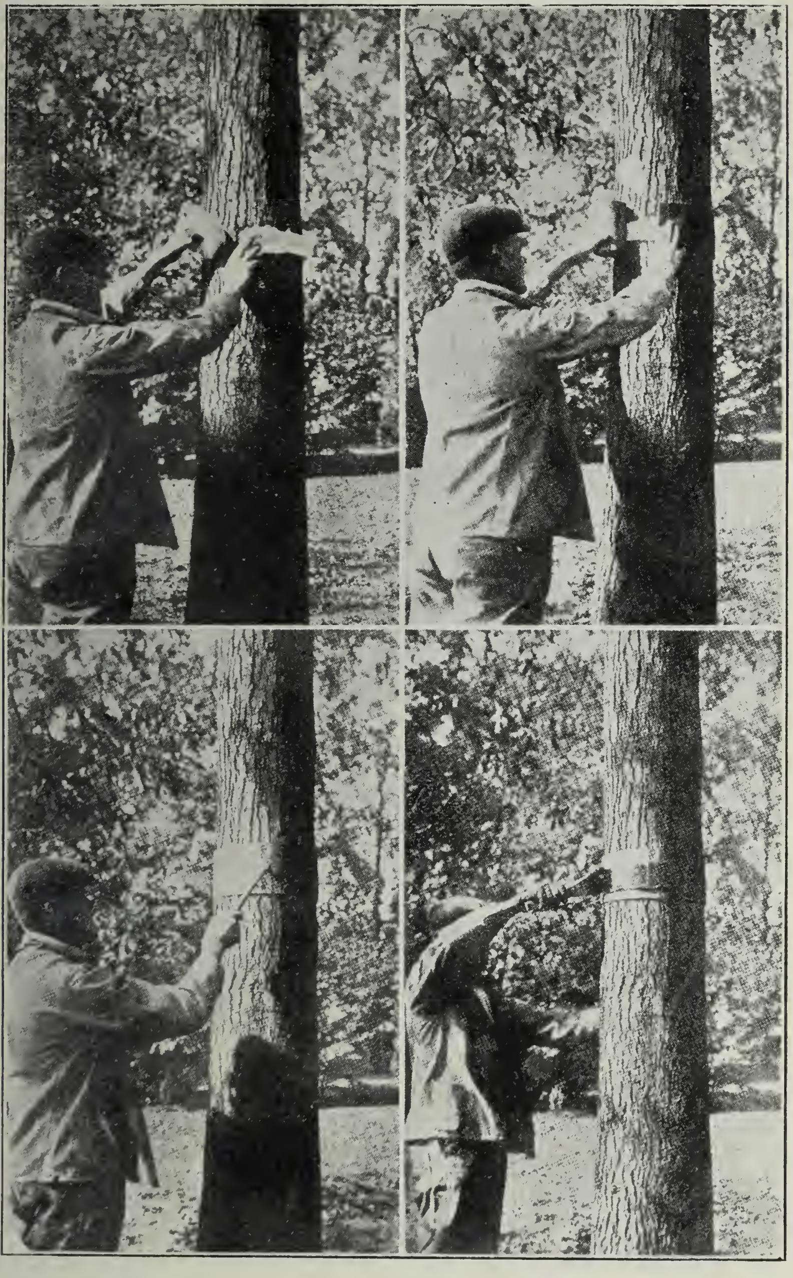

FIGURE 5.—Method of applying sticky bands to protect trees from canker-worms. (After Britton.)

close all crevices between the tree and the band, or a strip of cotton batting (cheapest grade) about two inches wide should first be placed around the tree, and this covered with the band of tarred paper. The paper should be drawn snugly enough to press the thick band of cotton into the crevices. (Fig. 5.) The band can be easily fastened at the end with three sharp-pointed tacks about three-fourths of an inch long. If the paper band is much wider than the narrow cotton one it will completely cover it, and thus avoid the unsightly appearance of cotton showing either above or below the edges of the paper. (Fig. 6.)

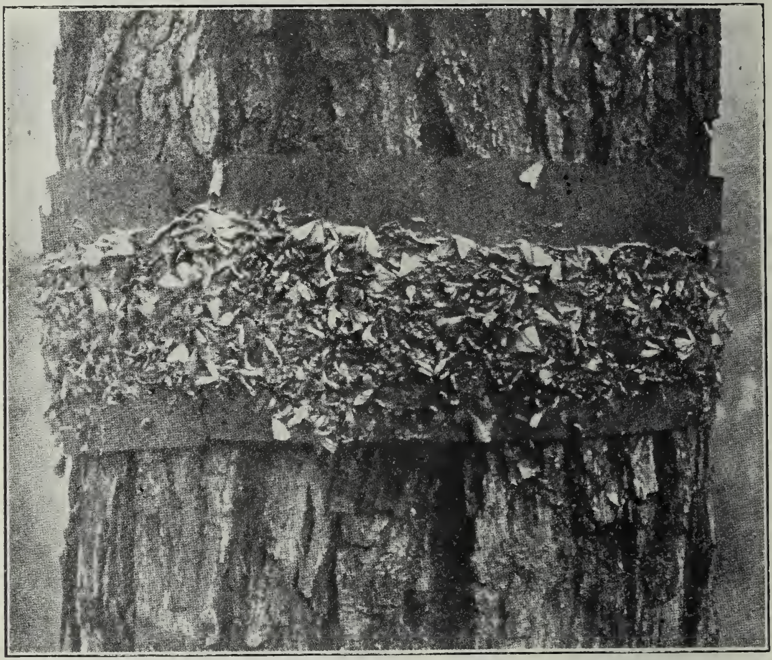

FIGURE 6.—Adult male and female moths on sticky bands. Cotton completely covered. (After Britton.)

A number of substances of a sticky nature may be used, such as pine tar, coal tar, printers' ink, and dendrolene, but the best substance, and one that remains sticky for several days, is "Tree Tanglefoot," a preparation sold by O. & W. Thum Company, Grand Rapids, Mich. The "tanglefoot" should be spread upon the band with a wooden paddle, leaving a smooth coating about one-eighth of an inch thick. On badly infested trees it is sometimes necessary to comb or renew the sticky substance frequently, as many of the females may be able to cross the bands over the dead bodies and wings of males, which may completely cover the sticky portion of the band. (Fig. 7.)

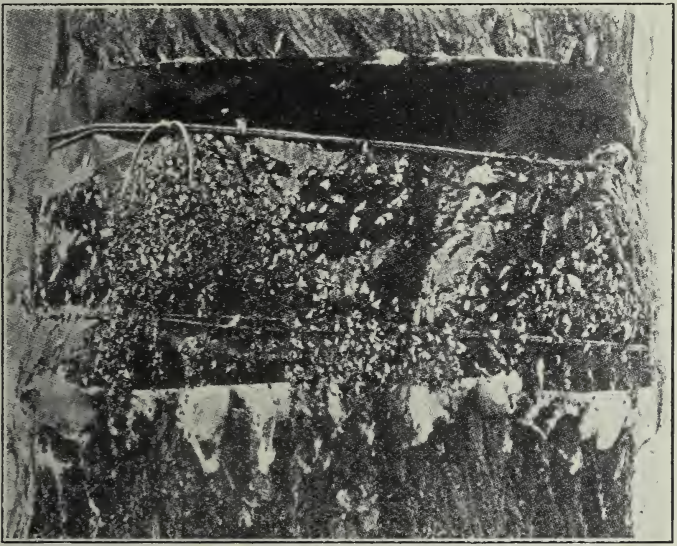

FIGURE 7.—Adult male and female moths on sticky band. Cotton stuffed behind the band. (After Slingerland and Crosby.)

The use of the sticky bands is especially recommended for large elms or other shade trees that would be difficult to spray. If the sticky substance is applied directly to the bark it will show as a disfiguring mark for many years, while if applied to bands of paper as described, the band can be removed from the tree at any time without leaving any sign or scar. Moreover, so much more of the "tanglefoot" is necessary to fill the cracks of the rough bark in making an efficient barrier that the cost equals that involved in the banding method.

To make a successful fight against canker-worms, too much emphasis can not be laid upon the necessity of beginning promptly. If the banding method is used, the bands must be on the tree early enough to prevent the ascent of the wingless female moths, which takes place during the first warm days of March, or even February. If the spraying method is used, the spray must be applied just as soon as the worms appear, which is usually about the time the apple tree unfolds its leaves.

FEBRUARY 1, 1915.

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KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Experiment Station.

CIRCULAR No. 47.
FEBRUARY 15, 1915.

DEPARTMENT OF ENTOMOLOGY.

Insects Destructive to Grain and Grain Products Stored in Bins and Granaries.

GEORGE A. DEAN.

A large amount of wheat, estimated at 30,000,000 bushels, is still stored in bins and granaries and with the opening of spring the infesting insects, which were unusually abundant last fall, will again become very active and will work so vigorously that the farmer must kill them, dispose of his grain, or allow them seriously to damage it. The infesting insects, if left unchecked, can easily cause a loss equal to from five to fifteen per cent of the total value of the grain.

Of the several species of beetles and their larvæ attacking stored grains, not more than five or six are commonly found in the farmers' bins, of which the two species of grain weevils (snout beetles or little "bill-bugs"), the grain molitor, the cadelle, and the saw-toothed grain beetle are the most damaging. To these may be added three species of moths, the Angoumois grain moth, which is the most serious attacking corn, and the two meal moths, which are the serious ones in meal, bran, or any other ground grain products. All of these species are of small size, none of the beetles exceeding five-eighths of an inch in length, and most of them being less than one-fourth of an inch long. They are reddish, brown, or black in color. The moths are tiny "millers," and with the exception of the Angoumois grain moth, the work of their larvæ in bins, granaries and mills may be distinguished from that of the beetles by the presence of web or silk in the grain, bran, meal or flour. Only two of these insects are true weevils, although the farmer and the miller usually apply the term "weevil" to most of them.

Measures to be employed in the control of this class of insects are both insecticidal and preventive.

INSECTICIDAL METHODS OF CONTROL.

Fortunately, it matters little what species may be causing the trouble, for all succumb to the same treatment. The simplest, most effective, and least expensive remedy for all insects infesting the farmers' grain and grain products stored in tight bins is careful fumigation with carbon bisulphide.

While carbon bisulphide fumigation is effective and is strongly recommended for all insect infestations in the farmers' bins, it is not an effective fumigation in flour mills, and since there is such an element of danger from fire in its use in these mills and in large grain elevators, it is not recommended for this purpose. It is prohibited by mill and grain-elevator insurance companies, and the use of it voids the policies.

The Amount of Carbon Bisulphide to be Used. The amount of liquid to be used depends on the temperature, on the size and shape of the building, on its tightness, and on the nature of the attack. Since temperature is a very important factor in the success of fumigation, it should always be given careful consideration. Our fumigation experiments, conducted in practically an air-tight chamber with the larvæ, the pupæ, and the adults of the confused flour beetle (*Tribolium confusum*) and the adults of the rice weevil (*Calandra oryzæ*), show that while at a temperature of 90° F. one pound of carbon bisulphide is sufficient for every 500 cubic feet of space, at a temperature of 80° F. one pound of the liquid is required for 400 cubic feet of space, and at a temperature of 70° F. one pound of the liquid is required for every 300 cubic feet of space. At a temperature below 60° F. the amount of carbon bisulphide required and the results obtained are so unsatisfactory that it is impracticable to attempt fumigation. If the building is reasonably tight and the temperature is above 70° F., five pounds of carbon bisulphide is sufficient for every 1,000 cubic feet of space, or one pound for every 25 bushels of grain. In case the building or bins are not sufficiently tight to allow thorough fumigation, the amount of the liquid should be doubled or ever tripled.

Preparation. The building and bins must be as nearly airtight as possible in order that the vapor may remain in all parts of the space in full strength and for the required time. The vapor must enter all cracks and crevices by diffusion. Doors should be wedged tight. If they are loose, either paper should be pasted over them, or cotton batting should be inserted in the openings with a case knife. A similar treatment should be given all holes and cracks in the wall and floor. The batting should be packed tightly. The door and one or two windows should be so arranged that they can be opened from the outside when fumigation is completed. Care should be taken to have everything ready and in place, so that after the distribution of the liquid has begun it will be unnecessary to stop to adjust anything. Everything should be done to avoid unnecessary delays and to facilitate the rapid evaporation of the liquid.

Placing the Liquid. Since the vapor is heavier than air and settles to the lower parts, the liquid should be placed in shallow pans at the top of the bins or buildings. It should be well distributed, not more than a pound in a place, and even less than this amount where it is practical to have it distributed in small quantities. If larger amounts are used in one place, it should be placed in pans having considerable evaporating surface. In large bins, to hasten and to equalize the operation, it is well to put a quantity of the liquid in the center of the grain by thrusting into it a gas pipe, loosely plugged at one end, down which the carbon bisulphide may be poured, the plug being then loosened with a rod. The plug should be attached to the rod in order that it may be withdrawn. The liquid may be applied or sprinkled directly upon the grain. Unless used in excessive quantities the liquid will not injure the edible or germinative qualities of the grains or seeds.

If a building of more than one floor is to be fumigated the operator should begin on the first floor and work upward, and after placing the liquid in the upper story, leave the building through a window that he can close after him. If it is impossible to get out from the upper story, the carbon bisulphide should first be distributed there, and the operator should work downward as rapidly as possible to avoid the settling vapor.

Length of Exposure. The bins or building should be allowed to fumigate 36 hours. If the grain is not to be used for germinating purposes, it is well to subject it to the fumigation for 48 hours. The best plan usually is to apply the liquid on a Saturday afternoon and leave the building closed until the following Monday.

Ventilation. Doors and windows should be opened wide and the building or bins aired thoroughly one or two hours before being entered. Slight traces of the odor will linger in corners and other places where the air does not circulate freely, but these will gradually disappear.

Precaution. The vapor of this liquid is highly inflammable and explosive. No fire or light of any sort should be allowed about the building while the fumigation is in progress. The application should always be made in daylight, for artificial light of any kind is dangerous. Electric lights must not be used, since when turning them on or off there is always danger of producing a spark. It is not safe to have heat of any kind in the building while the fumigation is in progress.

PREVENTIVE METHODS OF CONTROL.

In order that infestation in the stack may be avoided, the grain should be threshed as soon after harvesting as practicable. The writer has found on several occasions that where the grain was left in the stack until early fall it was seriously infested with the Angoumois grain moth and the grain weevil. Fresh grain should not be exposed to attack by storage in bins or granaries containing infested grain. Before storing, the old grain should be removed and the floors, walls, and ceilings of the bins thoroughly cleaned. If the granary has been badly infested, it should be fumigated before the new grain is stored. Since cleanliness is very important in the prevention of injury by these insects, all dust, dirt, rubbish, refuse grain, flour, and meal, which serve only as breeding-places, should be removed. If the grain is infested by the grain or meal moth, frequent agitation or handling of the grain will destroy many of them, because they are unable to free themselves from a mass of it and perish in the attempt. A liberal use of air-slaked lime is recommended for dusting in corners and along the edges of bins. This lime should be dusted in the bins as soon as they are empty, but removed before storing the grain. Granaries, as far as possible, should be constructed so as to be easily kept clean, and in such a manner as not to allow materials to collect and afford lurking places for insects. Granaries should also be constructed so as to avoid dampness. This dampness induces a condition in the grain termed "heating," and thus favors a rapid increase in insect life. It is also a fact that when insects are abundant in grain, they cause, in some unexplained manner, a rise in temperature. If corn is showing infestation in the open crib, it should be shelled at once, and, after it is stored in tight bins or in the granary, should be fumigated with carbon bisulphide.

KANSAS STATE AGRICULTURAL COLLEGE

Agricultural Experiment Station

CIRCULAR No. 48
February 12, 1915

Raising Calves on Skim Milk

O. E. REED, Dairy Husbandman.

In many localities a great deal of money is lost each year by feeding calves on whole milk, or by letting them suck the cows. This is often due to the fact that those who practice such methods do not believe good calves can be raised on skim milk. They rather picture the skim-milk calf as being a small, unhealthy, stunted individual that is absolutely worthless. Many such cases can be found. However, such results should not be charged up to the skim milk, but rather to the ignorance or carelessness of the feeder. It has been shown that as good calves can be raised on skim milk as with whole milk. Several years ago the Kansas Experiment Station carried on experiments to demonstrate the value of skim milk as compared with whole milk as a food for calves. Thirty calves were divided into three groups. One lot was fed on skim milk, another on whole milk, and still another lot was nursed by their mothers. The following table shows the results of these experiments:

Experiment.	No. of calves.	Days fed.	Aver. gain per head. *pounds*	Daily gain per head. *pounds*	Cost per 100 lbs. gain.
Skim milk	10	154	223	1.51	$2.26
Whole milk	10	154	287	1.86	7.60
Running with dam	10	154	248	1.77	4.41

The calves nursed by their dams and those fed whole milk made slightly better gains than those fed on skim milk, but it was at much greater expense. The skim-milk calves consumed 122 pounds of grain per hundred pounds of gain, while the whole-milk calves consumed 58 pounds of grain and 31.8 pounds of butter fat in the milk. At this rate a hundred pounds of grain is equivalent in feeding value to 48 pounds of fat. After the calf-feeding experiment had closed, the calves, which were steers, were put in the feed lot and fed for a period of seven months. The results of this experiment are very interesting. The calves in the skim-milk lot made the best gains, those that were fed on whole milk ranked second, while the lot raised by the dams stood last.

Skim-milk calves will not look quite so thrifty for the first few months as calves fed on whole milk or allowed to run with their mothers, but at the end of the year there will not be much difference in size; if any difference, the skim-milk calves will be better, provided they have been properly fed. The skim-milk calf becomes accustomed to eating grain and hay early in life, consequently when it is weaned the change of feed is not so noticeable as it is with the whole-milk calf, and it does not suffer a setback at this time. The calf that has been fed on whole milk has not been accustomed to getting very much of its nutrients from grain and hay, and invariably does not gain as rapidly as does the skim-milk calf for the first two or three weeks after it is weaned.

The study of the following table will reveal the fact that there is very little difference between the composition of whole and skim milk:

	Whole milk.	Skim milk.
Water	87.10%	90.50%
Fat	3.90	.10
Casein and albumin	3.40	3.57
Sugar	4.75	4.95
Ash	.75	.78

The skim milk differs from whole milk in that most of the fat has been removed. The other constituents are proportionately increased. The fat in milk is the least important constituent as far as calf raising is concerned. On the other hand, the fat is the most important constituent in relation to the manufacture of dairy products. The fat is used by the animal body to supply heat and energy and store fat on the body. Other feeding stuff, such as corn or similar grain, can be fed to take the place of fat.

The casein, albumin and ash are the most important constituents of milk for the growing calf. These substances are used by the body for making muscle, nerve, bone, hair, hide and hoofs. These elements are left in skim milk. Then by separating the whole milk, selling the high-priced butter fat, and substituting a cheap grain ration instead, calves can be raised more cheaply.

TAKING THE CALF FROM ITS MOTHER.

The exact time of taking the calf from its mother will depend upon the condition of the calf and its mother at the time of calving. If the calf is strong and in good condition it may be taken away immediately, without allowing it to nurse. It will be an easier task to teach the calf to drink from the pail if it is taken away from the mother at this time. If the calf is weak at birth, or if the cow's udder is inflamed or caked, it is a better practice to allow it to remain with its mother for several days. In case the calf is taken from its mother immediately it should by all means receive her first milk. The milk at this time contains a high percentage of protein and ash, which act as a laxative and tonic and are very effective in cleaning out the digestive tract and stimulating the digestive organs. In some cases it is not safe to feed calves the milk from their mothers after the first few days. The milk from cows belonging to the high-testing breeds is very often too rich in fat for the young calf, and should be diluted with skim milk, or milk from some other cow should be fed.

PLATE 1.—Group of Holstein calves raised on skim milk at the Fort Hays Experiment Station.

QUANTITY OF MILK TO FEED.

The quantity of milk to feed the calf at this time is very important. Under natural conditions the calf gets its milk often and in small quantities, and the more closely Nature is imitated the greater the success. The calf of average size should receive about eight pounds of whole milk a day at first. Large calves should have more than this amount. The milk may be fed in two feeds, night and morning, or better results may be obtained by feeding it three times a day. As the calf grows older the amount should be gradually increased. The best guide as to the amount which should be fed is the calf's appetite. It should be fed sufficiently, but never overfed, and it is a good practice to always keep the calf a little hungry. It should take the last milk from the pail with the same relish that it took the first. It must be remembered that the calf has a small stomach, and there is great danger of overfeeding it. As a general guide for the beginner the following method may be used to determine the quantity of milk to feed.

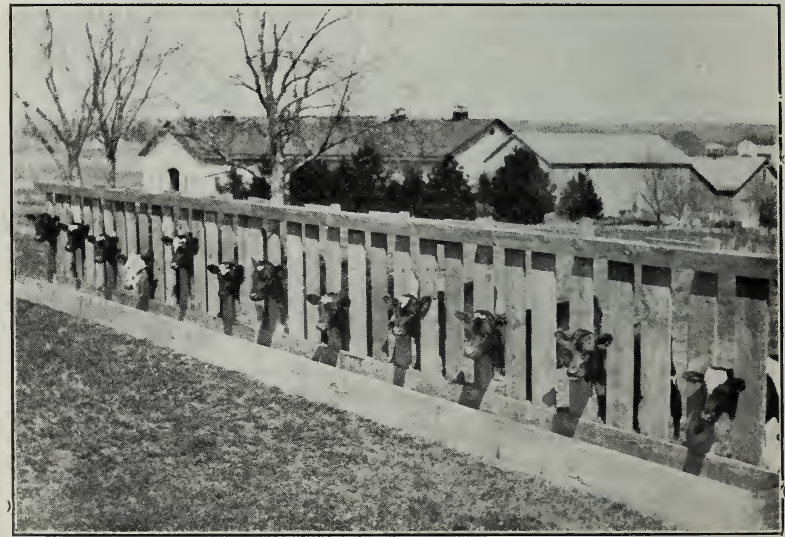

PLATE 2.—The above picture shows the construction of home-made stanchions for calves. Such stanchions are very serviceable in feeding calves by hand.

For the first 100 pounds live weight feed 10 pounds of milk per day.

For the second 100 pounds add 5 pounds of milk per day.

For the third 100 pounds add 2½ pounds of milk per day.

CHANGING TO SKIM MILK.

The time to change the calf from whole milk to skim milk will depend largely upon the development of the calf. If the calf is strong and well developed, it may be changed to skim milk at the end of the second week. This change should be made gradually by substituting a small quantity of skim milk for whole milk in the daily ration. About a week or ten days should be taken for this change. In this way the calf will go off the whole milk gradually and will not have a distaste for the skim milk.

TEMPERATURE OF MILK.

Care should always be taken to have the milk warm and sweet; especially is this necessary when feeding the young calf. As the calf grows older it will do just as well on cooler milk if it is fed at the same temperature every day. The right temperature for the milk fed the young calf is blood heat, 100° F. The milk should be as nearly this temperature as it is possible to get it. There is no way by which the digestive system of the young calf can be upset more easily than by feeding cold milk at one meal and warm milk at another. If there is any doubt about the temperature, or if the milk has to be warmed at all, the thermometer should be used. Judging the temperature of milk by putting the finger into it is not satisfactory. Milk at 90° F. will feel warmer on a cold morning than it will on a warm morning, and the calf's digestive system is very sensitive to any change. It is also important to feed the milk sweet. One feed of sour milk may upset the digestive system of the young calf for months, and one feed of such milk often causes the death of the calf. It is better to let the calf miss one or even two feeds than to feed it on sour milk.

CLEAN PAILS NECESSARY.

The pails from which the milk is fed should be kept as clean as possible. They should be kept as clean as the milk utensils. If any milk is left in them it will sour, and the calf will soon show the effect. The pails should be thoroughly cleansed and sterilized often.

LENGTH OF TIME TO FEED SKIM MILK.

The length of time that the calf should be fed on skim milk will depend upon the amount of skim milk available for this purpose. Some feeders wean their calves at four months of age, but it is a better practice to feed skim milk until the calves are six months old. If one has an abundance of skim milk it is a profitable practice to feed heifers until they are eight months or a year old. This will insure a better growth and better development.

FEEDING GRAIN AND HAY.

At the time the calf is changed from whole milk to skim milk it will begin to eat grain. The best way to get the calf started eating grain is by placing a little grain in its mouth after it has consumed its milk. It will like the taste of grain, and will soon eat without assistance if the grain is placed within its reach. A great many feeders practice the feeding of grain with the milk. This is a serious mistake, especially if the grain consists of corn or other starchy feed. Such feed as corn must be acted upon by the saliva of the mouth in order to insure its proper digestion. When the grain is fed with the milk the calf simply gulps it down and does not masticate it in the least. In such cases indigestion often follows. When the calf once begins to eat grain readily, only such an amount should be given it as will be cleaned up at each meal. Here again the appetite of the calf is the best guide as to the amount of grain to feed. Usually the calf will not eat over a half pound of grain per day for the first two months. From this time until it is six months old a pound of grain per day will be sufficient.

PLATE 3.—Group of dairy calves raised on skim milk at the Kansas State Agricultural College.

It has been shown that skim milk is deficient in fat, and in supplementing it one must make good this deficiency. Grains which contain a high percentage of carbohydrates may be substituted for the butter fat. Corn or kafir contain a high per cent of this substance, and on account of their low cost in the corn belt they are the logical grains to feed with the skim milk. Many farmers and dairymen make the mistake of feeding linseed-oil meal with skim milk, as the only grain ration fed. This mistake is made on account of the idea that some have regarding the composition of oil meal. Many assume that oil meal contains a high per cent of oil, which will replace the fat that has been taken out of the milk. Linseed-oil meal is valuable for feeding on account of the high content of protein. It does not contain a very high per cent of oil. Oil meal may be fed in connection with corn, but this is not entirely necessary, and it is very expensive. The corn has invariably given the best results as a supplement to skim milk. When teaching the calf to eat grain it is better to use corn chop. When the calf gets a little older shelled corn or kafir may be fed.

Hay should be kept before the calf after it is two weeks old. At this age the calf will begin to nibble at the hay, and will soon consume quite a little of it. The eating of hay should be encouraged by keeping nice, clean, bright hay within the reach of the calf at all times. For young calves, mixed or prairie hay is better than alfalfa or clover. The latter are usually too laxative and have a tendency to produce scours. After the calf is two or three months old it will do much better on alfalfa, and will eat a great deal more of it than of the mixed hays. If alfalfa can not be had at this time, good clover or cowpea hay should be fed. If the calf is on pasture it will not be necessary to feed any hay.

THE CALF NEEDS WATER.

Clean, fresh water should be provided for the calf at all times. Many feeders assume that the calf does not need water on account of drinking milk. It will consume a large amount of water even after drinking fifteen or twenty pounds of skim milk per day.

After the calf is weaned from milk the grain ration should be somewhat changed. The object in forming a grain ration for any growing animal is to feed it bone- and muscle-forming feeds. The grain ration at this time will depend upon the kind of roughage fed. If alfalfa hay is used the calves will do well on a ration of corn alone, or mixed corn and oats.

or corn and bran. If mixed or prairie hay, cane or corn fodder is fed, the grain ration should be changed somewhat. More nitrogenous foods, such as bran, linseed-oil meal and cottonseed-oil meal should make up the grain ration. If the calves are stunted by lack of proper food at this time they will usually develop into undersized cows.

RAISING CALVES WITHOUT SKIM MILK.

On many farms, especially those near the larger milk markets, the whole milk is sold from the farm. On such farms the problem of feeding calves is a more serious one. Here the calf must be raised on the minimum quantity of milk, and this is usually whole milk. Some farmers solve the problem of raising the calves by letting two of them nurse one cow. Often there are cows in the herd that are hard to milk, and such cows are turned over to the calves. In such cases only the very best heifer calves are raised. Where there is ready market for the whole milk it is a losing proposition to feed whole milk to a calf that will finally sell on the market for veal.

PLATE 4.—Calf barn used expressly for calves at the Kansas State Agricultural College. This barn contains the small pens with stanchions, as described in the bulletin.

Another solution of this problem is to feed the minimum quantity of milk, getting the calf to eat grain, or gruels made of grain, as early as possible. Some feed the milk for two or three months, and at the end of this time the calf is entirely fed on dry feed. This is probably the best method to follow.

There are a great many milk substitutes advertised on the market to-day, but these are usually expensive, and for the best results some milk should be fed with them.

STABLING THE CALVES.

The calves should by all means be kept in clean, well-lighted and ventilated stables. Where plenty of barn or shed room is at hand, the best method for handling the calves is to keep each one in a separate pen. A pen three feet wide, five feet long and three feet high is large enough to accommodate the calf until it is four to six months old. There are many advantages in keeping the calves in this manner. The calves will not suck each other's ears when they get through drinking their milk, and thereby cause the ears to freeze in cold weather, and they can be given more individual attention. They can be fed as individuals. A case of scours among calves may be located more readily in this manner, and a remedy may be applied at once. Where there is less room to be had, the stanchions will usually give the best results. A stanchion made of wood will be entirely satisfactory. The stanchion should be made from 3 to 3½ feet high and 18 to 24 inches from center to center, and the neck space should be 4 to 5 inches wide. The stanchion is built in the same manner as the old-style rigid stanchion. The feed manger may be made 12 to 14 inches wide, or wide enough to accommodate the milk pail. The calf should be fastened while it drinks the milk, and the grain fed immediately afterward. By the time the calves have eaten the grain they will lose the desire to suck each other's ears. A part of the manger may be used for hay, but the calves should be loosened from the stanchions after they have eaten their grain. The calf pens and stanchions should be built in the south side of the barn, where plenty of sunshine and light can be had. There is no disinfectant that will take the place of sunshine. During the summer the calf should have access to a pasture lot where there is plenty of shade.

SPRING AND FALL CALVES.

The best time of the year to have the calves dropped will depend somewhat upon the market for the product. In the cheese-making district, or where the cream is sold for ice-cream making, it is more profitable to have the cows freshen in the spring. Where butter or cream is sold, or where milk is sold for market purposes, it is better to have the cows freshen in the fall. Fall-dropped calves that are to be hand-raised will usually make a better growth than calves born in the spring. During the fall and winter more time can be given to the care of the calf, and when spring comes it is ready to make good use of the pasture, and will not be any further trouble or care. In the fall, when calves are housed in their winter quarters, they are strong, and on account of being accustomed to subsisting on coarse foods, they will do well on dry feed. The spring-dropped calf is compelled to subsist on dry feed after it is weaned, and will not take hold so readily, thus suffering a set-back in its growth.

CALF SCOURS.

The most common disease of the young calf is indigestion, or scours. Naturally the digestive system of the young calf is weak and is very easily upset. The old adage, "An ounce of prevention is worth a pound of cure," is very applicable here.

There are two kinds of scours that commonly affect the young calf—white scours, sometimes called calf cholera, and common scours, caused from indigestion. The white scours is a contagious form, and if the calf becomes affected at all it is within a few days after birth. The germs gain entrance to the body through the umbilical cord soon after birth. The remedy for this disease is a preventive one, and the best way to insure against it is to keep the stalls and pens clean. Stalls used for calving purposes should be cleansed and disinfected after each calf is born. Additional precaution should be taken by tying a string around the navel cord of the young calf immediately after it is born, and applying some good disinfectant to the exposed parts.

The common scours, or indigestion, may usually be traced to faulty methods in feeding the young calf. The principal causes are as follows: overfeeding, feeding cold milk, irregular feeding, feeding alfalfa or other highly nitrogenous hay to the young calf, using dirty pails, and dirty stables.

The first sign of indigestion or scours among calves is usually the characteristic foul-smelling dung. When a calf shows the first signs of scours the milk should be reduced one-half or more, and then gradually increased again as the calf improves. This method of treatment is usually sufficient to check a mild case. There have been many remedies suggested for treatment of the scours, and all are used with more or less success. The feeding of dried blood to calves has proved very effective. This may be fed by adding about a teaspoonful of soluble dried blood to the milk and stirring it in well. Dried blood not only acts as a tonic, but often is fed along with milk at each feed on account of its feeding value as well as its value as preventive treatment against the scours. A fresh egg given to the calf when the scours is first noticed often checks the attack. Castor oil is also used with good results. Two tablespoonfuls is sufficient for a dose. This may be given as drench mixed with milk.

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COLLEGE OF AGRICULTURE READING ROOM

KANSAS STATE AGRICULTURAL COLLEGE

Agricultural Experiment Station

CIRCULAR NO. 49

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HORTICULTURAL DEPARTMENT

Pruning

FRED S. MERRILL

TOOLS

Do you want to prune your fruit trees successfully? If you do, good tools are essential.

No man who pretends to be a fruit grower will be satisfied to work without the best implements.

For pruning the young trees the best tool is the pruning knife, preferably of the hawk-bill type. If the knife is kept well sharpened, the cuts may be made smoother and closer to the trunk than with any other tool.

SHEARS FOR YOUNG TREES

The pruning shears or hand shears are widely used, especially for young trees. There are many different types of shears, but there are few good ones. The steel should be considered in making a selection. The cheap shears will always prove most expensive. The shears having a volute spring have given better satisfaction than most types. The hand shears can be worked more easily and rapidly than the knife, but the cuts cannot be made so close. A sloping cut should be made to prevent crushing the limbs.

The long handled shears are widely used among fruit growers because of the speed with which they may be worked. This speed induces carelessness and cuts are often poorly made. This type of pruner leaves stubs, and they should always be avoided.

HEADING BACK SMALL LIMBS

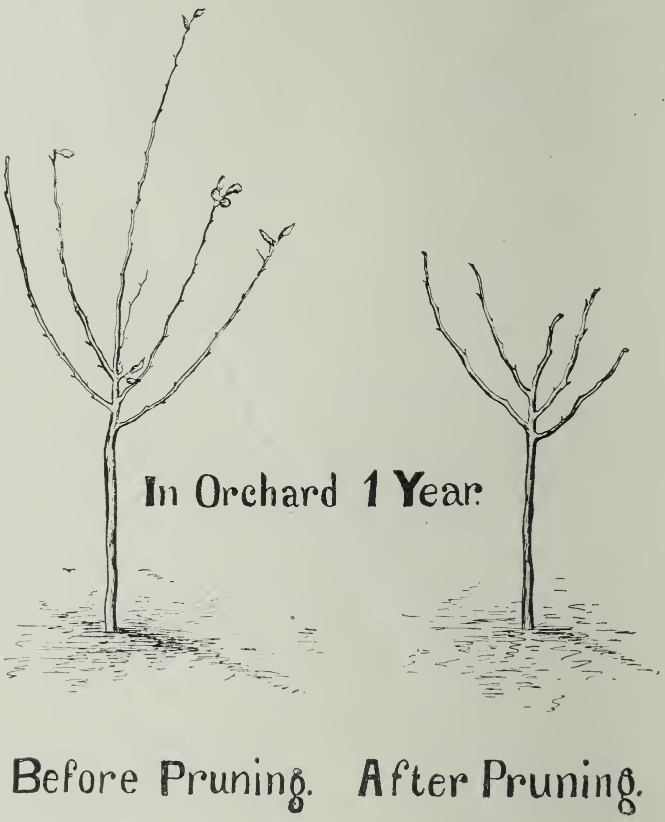
The pole pruner cannot be safely used except in heading back the small limbs. Here it is a great time saver and is a valuable tool. It is sure to leave stubs, however, when used on larger limbs.

The pruning saw is the most important tool in dealing with the older trees, especially in the neglected orchard. Many of the saws offered for this work are not only worthless but a menace. The two edged saw has nothing to recommend its use, and it may badly damage the trees. The meat saw type is recommended by some men because the blade can be turned so that work may be done in close crotches. The point that gives this saw its advantage is also a point against it. The blade has a tendency to turn while cutting and often makes a crooked cut that requires another attack before a smooth surface can be had. It is also too heavy, and the back prevents a continual cut through a large limb. It cuts rapidly, however, and the low prices of blades makes it possible to have a sharp saw at all times.

USING CALIFORNIA SAW

The California saw has a curved blade making a draw cut. This saw is well adapted to light work in the orchard and can be used to advantage in the smaller trees.

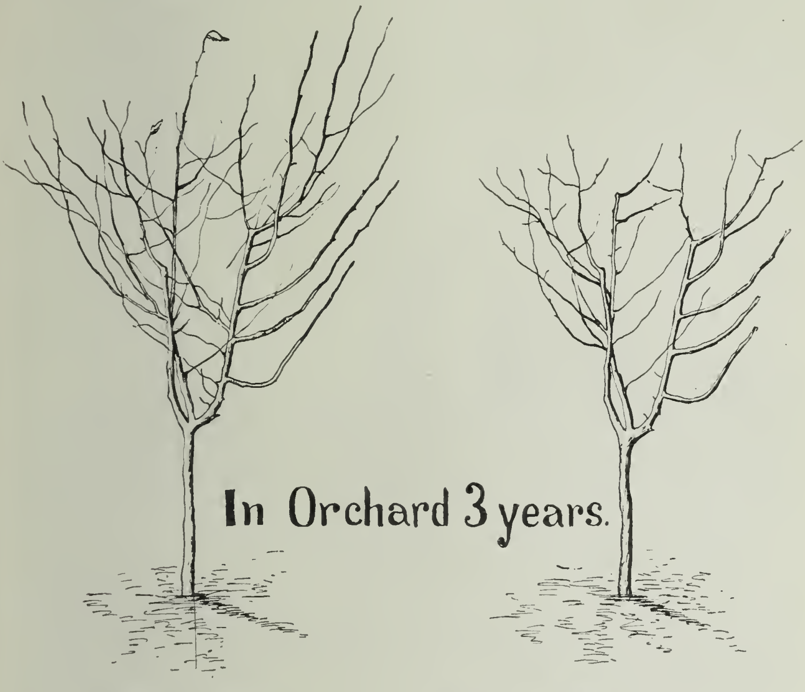
A saw that has been used widely in the east can be generally recommended for the heavier pruning. This saw has a comparatively narrow blade, being 3½ inches wide at the butt and 1 inch wide at the tip, and having seven teeth to the inch. It has a full grip handle so that it may be used with the gloved hand. The blade may be had in lengths varying from 18 to 24 inches. This saw works rapidly and is light in weight, durable, and well balanced. The narrow blade makes it adapted to close work.


In Orchard 1 Year.
Before Pruning.
After Pruning.

Many implements have been offered that are attached to poles, but most of them are too unwieldly and many are too crude in workmanship to merit their use.

PRUNER MUST KNOW FACTS

Before pruning can be judiciously carried out, the pruner should have some knowledge of the way in which the fruit buds are formed and on what portion of the tree the fruit is borne. The orchardist who practiced the same system of pruning for his apples as for his peaches would make a failure of his crop.



In Orchard 3 years.

Before Pruning. After Pruning.

The apple produces its fruit buds on short crooked or irregular spurs that are 2 or more years old. In pruning, the object should be to produce the formation of new spurs and to save all that are already on the tree. Don't let a desire for regularity influence you to cut off these ugly objects, for they are the source of your crop. If the growing conditions are good, these spurs may persist for many years, but if the sunlight is shut out they soon die. If these die or are broken, they can never grow again, and the only way they may be replaced is by training watersprouts. This is a slow and uncertain process.

SEASON

The time for pruning will be governed to a large extent by the condition of the orchard. Where winter pruning is not too extensive, it is usually carried on in the late winter months. Pruning in winter is not dangerous to the tree, nor is it dangerous to saw off a limb when the wood is frozen. The greatest drawback to midwinter pruning is the inconvenience to the pruner.

The effect of heavy winter pruning is to promote a heavy wood and water sprout growth. The reason for this is that the roots have been unchanged while the top has been reduced. To restore the balance that normally exists between the top and the root system, a vigorous growth takes place. This is important in rejuvenating old or neglected trees, but should be avoided in healthy trees of bearing age. A light pruning, however, will not cause the excessive wood growth, and may keep a tree in good physical condition.

TO INCREASE FRUIT PRODUCTION

Summer pruning should be done after the rapid growth of the spring has been completed, generally in June or July. This type of pruning tends to overcome the production of water sprouts and heavy wood growth and is frequently recommended as an agent for increasing production and promoting fruit production in barren trees. The summer pruning must be light, consisting in pinching back the growing shoots, and is not possible except in trees that have been well cared for. Heavy pruning tends to cause the formation of secondary or lateral shoots on the limbs cut back. Summer pruning is made difficult by the heavy foliage that naturally

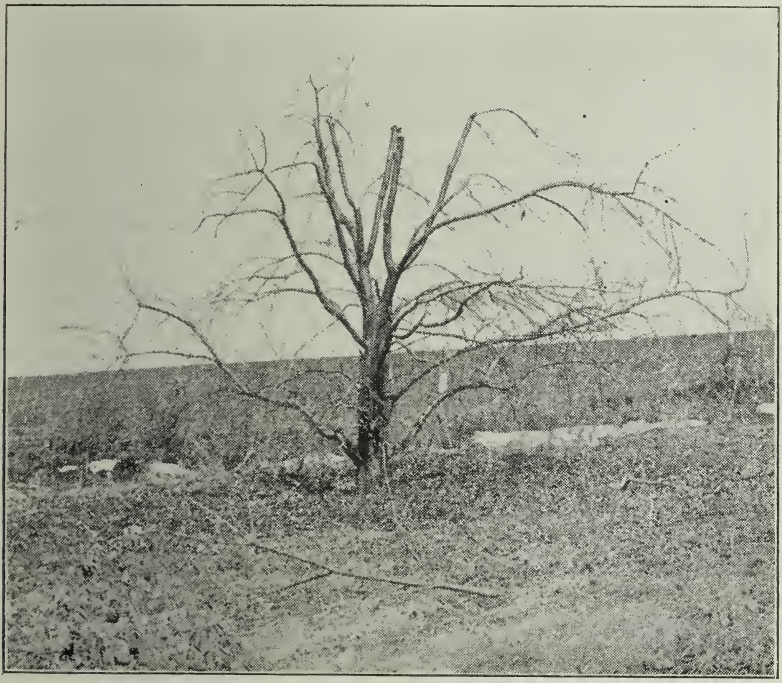
A MISSOURI PIPPIN BROKEN BY POOR DISTRIBUTION OF FRUIT exists at the time, and if the work is not carefully done, injury may be done to the growing fruit.

The pruning should be done annually. If it is done periodically, the tree becomes unbalanced and too many large limbs have to be removed. Such a condition is liable to be followed by heavy wood growth, and heavy fruit production does not take place in trees that are making rank wood growth.

KEEP FUNGOUS DISEASES OUT

All cuts should be made close to the limb from which the branch is to be cut, and the surface should be as smooth as possible. This enables the callus to form and grow most easily. A cut should never be made so that water can lodge on or around it, for such a condition will increase the danger of infection by fungous diseases.

If a large limb must be removed the pruner must be careful to prevent the limb from splitting at the base. He may do this by cutting off the limb a short distance from the trunk and then removing the stub. Even this additional work may be avoided by making an undercut from one-third to one-half through the limb. In making such a cut, it is often difficult to have the cuts meet and in that case the cuts should be smoothed over to aid the healing process.



THE SAME TREE AFTER RENOVATION

HOW TO TREAT YOUNG TREES

The usual age of trees at the time of planting is either one or two years. The pruning of a two-year-old tree at the time of planting is the same as for a one-year-old after one year's growth in the orchard.

The one-year-old tree is a straight whip, varying in length according to the variety and the conditions under which it has grown. The one-year tree has the advantage of the two-year tree in that the grower can start the head at the point at which he desires. The height of heading should be between 14 and 24 inches. Whether the trees are pruned to a high or a low head is a personal question and there are points in favor of both, but the weight of facts is in favor of a low-headed tree. The liability of damage from sun scald is lessened, the trees are easier to prune and to spray, the fruit is harvested more easily, and the trees are not so badly damaged by wind.

The method of pruning is the same for either type. The whip should be cut to a bud, generally on the south side, as the winds often reduce the growth on this side of the tree. A smooth cut should be made, sloping away from the bud to hasten healing over. If the trees are strong and the season favorable, from four to eight shoots will be sent out on the original stem. These shoots are to form the scaffold branches. From three to five of the strongest shoots should be selected and these should be evenly distributed about the trunk. Avoid leaving the branches that will later form crotches, for the trees will split under the first heavy load. After removing the unnecessary branches, the selected shoots should be cut back from one-fourth to one-third. The cut should be made smooth and close to a bud; to an outside bud for an upright tree and to an inside bud for the spreading and drooping branches.

IMPROVING FORM OF TREE

The pruning for the second and third years will consist in improving and developing the form of the tree. The main leaders should be cut back as in the younger trees. The lateral shoots should not be cut back so severely, for the grower should aim to develop a good strong tree. If the branches are crossing or interfering, they may be headed back, or the weaker shoots may be removed. All shoots that grow back through the center of the tree should be removed.

The pruning from the third year should be done so as to form a compact tree.

After this time, the formation of the fruit spurs should be started. If the growth is very rank, the spurs will form slowly, but in the slow growing varieties the spurs are formed early. Besides the natural formation, the heading back of the small shoots may convert these into fruit spurs. If this work on the young trees is done regularly, only small limbs will need to be removed, and the tree will come into bearing at an earlier age than otherwise.

WHERE WORK IS SIMPLE

For the bearing trees that have been cared for since planting, the work of pruning is simple. Several points are essential, however.

If the tree is growing too upright or too spreading, cut back the leaders to a side shoot that is growing in the desired direction. The upright tendency is more often found, in which event the heads should be shortened back to a side stock that is growing down and out. Do not cut the young shoots in the center, as they tend to send out laterals that are hard to prune into shape.

Keep the top sufficiently open so that the sunlight and air can freely circulate through the tops. This is necessary for the ripening of the fruit and the formation of fruit buds. Small limbs should be removed, but the work should not be done so that spaces are left in the top.

Cut out all diseased or dead wood.

Save all the fruit spurs and try to produce new ones.

Cut out all crossing and interfering branches.

In a well grown tree, all water sprouts should be removed. If any are needed to replace lost fruit spurs, they should be cut back to two buds. This operation may need to be repeated. All branches growing back through the center of the tree should be removed.

TREATING NEGLECTED ORCHARDS

There are many orchards that have not been properly pruned. These require a different system. As a rule, neglected trees are void of fruit bearing wood along the main branches and the tops are bushy and too high for spraying or for harvesting the fruit handily. In such trees the tops must be thinned out to admit more sunlight and air, the tops should be lowered, and new fruit bearing wood must be produced.

The first operation should be to remove all dead and diseased wood. The plan for the shape of the tree may then be made. The work of lowering the top should cover a period of three or four years. This disturbs the balance of the tree less than one very heavy pruning and also enables the tree to become gradually hardened to the greater exposure to the rays of the summer sun. The pruner must be very careful not to break off or remove more bearing wood during this operation than is necessary.

The tops of the trees should be lowered by cutting the leaders back to such lower branches as have a spreading habit of growth, preferably such as grow toward the outside of the tree. Trees that have long, slender branches are liable to break if a heavy crop is produced. Such limbs should be shortened more severely than the stocky limbs. The side growth may also be shortened, if necessary.

VIGOROUS GROWTH IS PRODUCED

This type of pruning causes a vigorous growth in the remaining limbs and is likely to produce many water sprouts. These should be thinned out if exceedingly abundant, but many will be necessary to form new fruit spurs. These should be pinched back early in the summer as they grow rapidly, but if left until the following winter, they should be cut back to two buds. Only one-year-old shoots should be used for this work, however. Besides heading back the water sprouts, it is usually necessary to regulate and thin out the vigorously growing top after the first year. An open headed tree can then be made and the cost of spraying and picking will be greatly reduced.

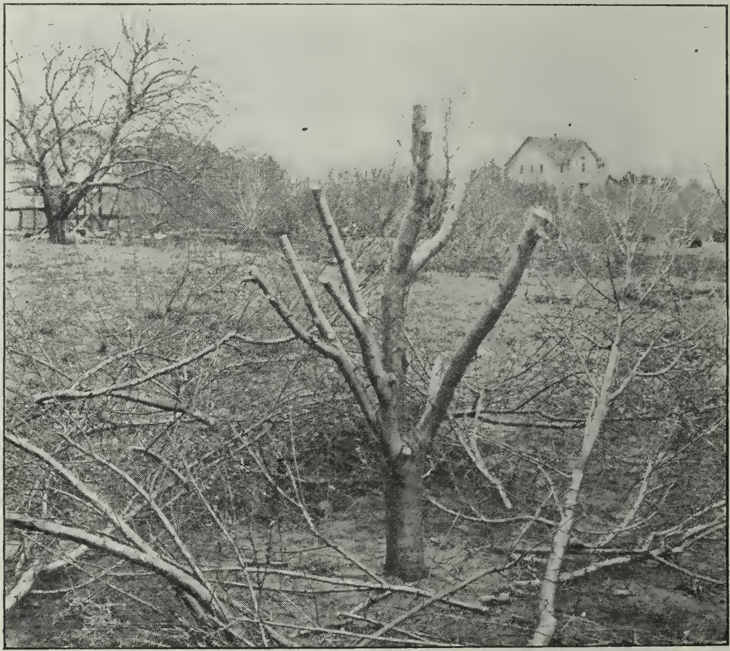
PEACH

The apple tree produces fruit buds on short, irregular spurs that persist for many years, while the peach produces fruit buds only on one-year-old wood. To secure a regular supply of fruit buds, the tree should be systematically pruned so as to produce an abundant new growth. The fruit buds form more readily at the extremities of the branches if the trees are unpruned, and under such circumstances a heavy crop may break the trees.

PLANT YEAR-OLD TREES

One-year-old trees are generally preferred for planting. These consist of a single stem, though with sometimes a few small shoots. The main stem should be cut back to a bud from 12 to 18 inches above the ground. The small side shoots are usually weak and immature and should be cut off close to the main stem. If the trees are large and the side shoots are well matured, they should be pruned in the same way as two-year-old trees.

At the end of the first season's growth, the one-year-old tree should have formed from five to eight side branches. Either three or four of the strongest shoots should be selected to form the scaffold branches of the tree. These limbs should form equal angles with the main stem. The selected limbs should be arranged to form a foundation for the head that will not be too close.


A PEACH TREE DEHORNED WHEN FAILURE OF THE CROP WAS CERTAIN

HEAD BACK THE LEADER

If the growing season is favorable and the culture is good, such of the scaffold branches will produce from three to four shoots and one strong leader during the first season's growth. The leader should be headed back from one-third to one-half of its length. It may be necessary to remove some of the laterals and these should be cut close to the shoots. The others should be cut back and trained to fill in the more open spaces in the framework of the tree.

The work in the following spring is similar. The low and open head should be carefully completed. The tree should be so balanced that the maximum production of fruit is produced at a height that will keep the cost of picking and spraying as low as possible.

PERFECT SHAPE OF TREE

When the tree reaches the bearing age the pruning should be planned in such a way that the general shape of the tree is perfected, though the most important object is to secure the formation of fruit buds. To produce this condition, the leaders or the strongest growing terminal shoots must be headed back, preferably to a side shoot growing toward the outside of the tree. Heading back the leaders induces the formation of many new shoots along the scaffold branches, and it is on these one-year-old shoots that the fruit for the following season is to be borne. Heading back the leaders also overcomes the tendency that the fruit bearing wood has of "creeping," or advancing along the main limbs. The production of large quantities of fruit near the ends of the branches increases the strain on the limbs and is liable to cause them to break off or split at the crotch.

The lateral shoots should also be shortened, and the young shoots in the center of the tree that have already borne fruit and the weaker twigs that have failed to produce buds should be cut out, as their usefulness has ceased.

PRUNING KNIFE IS BEST

The pruning knife is to be preferred to other tools, and is suited for all the work, if the pruning is done properly and regularly. The peach wood is brittle and splits easily. Consequently the careless use of pruning shears may be injurious.

The pruning season for this state is either late winter or early spring. This is not because of any benefits to the tree that may be derived by pruning at this season but because the danger of winterkilling makes it advisable to do the work after danger from freezing is past.

WHEN INJURED BY COLD

If a fruit tree has been seriously injured by low winter temperatures, the pruning methods already advised must be altered. The top of the tree should be severely cut back or dehorned. If the injury has not been complete, the pruning should be carried on to procure the maximum number of live buds, without regard to the form of the top. If the killing is complete, the limbs should be cut back to short stubs. With the top so greatly reduced, the undiminished root system will furnish a great surplus of plant food, which will be utilized in producing a heavy growth of new wood. As a rule, this growth is so rank that very few fruit buds are formed the first year, but the balance is more nearly restored during the second season and dehorned trees often produce large crops of excellent fruit. The later pruning of the dehorned trees is similar to that advised for bearing trees and usually must be severe.

Summer pruning is frequently advocated for peach trees after they reach the bearing age. In this work the leaders are pinched back in much the same manner as in winter pruning. The laterals and young shoots borne on the scaffold branches should be pinched back, as this treatment is believed to increase the production of fruit buds.

This work should be done in July or August. This date is somewhat later than the time advised for pruning the apple in summer, but peach fruit buds are formed later in the season than those of the apple.

WOUND TREATMENT

Whenever a noticeable scar is made, a dressing should be applied. This is necessary in order to keep out the many diseases that make their entrance through wounds. The wound dressing should be adhesive and impervious to water, and may be an antiseptic. Coal tar products are liable to burn the cambium and check callus growth.

A good wound paint may be made of white lead and raw linseed oil. This should be thick enough so that it will not run. The paint will penetrate better if the wood is allowed to dry out slightly, but too many times the painting is deferred too long.

GRAPES

The object in pruning grapes, as with other fruits, is to secure the maximum quantity of the highest possible quality of fruit. The vine that is left unpruned may produce a larger quantity than the pruned vine, but the size of the bunches and berries is greatly diminished and the quality of the fruit is inferior to that of the well pruned vine.

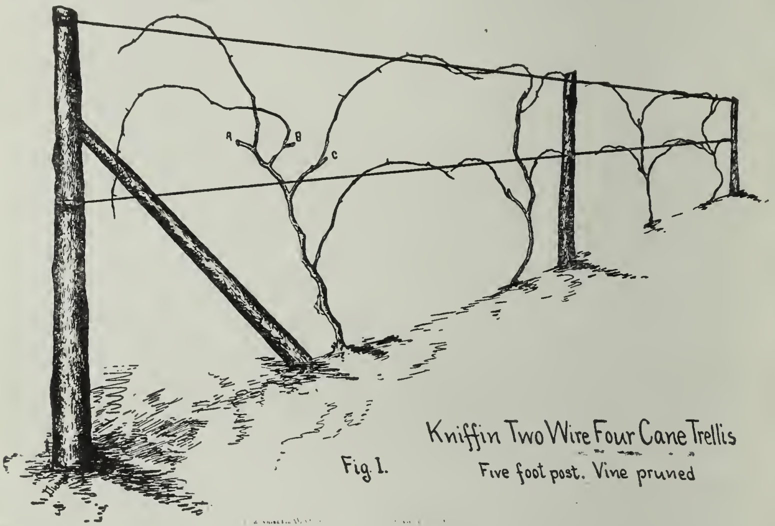


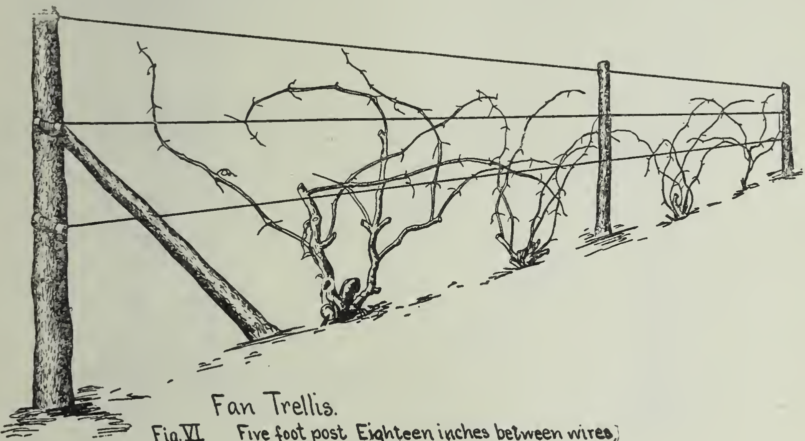
Fig. 1. Kniffin Two Wire Four Cane Trellis
Five foot post. Vine pruned

The fruit of the grape is borne on the new shoots which grow from buds formed on the preceding year's growth. The grower should know something of the habits of the variety before pruning. Varieties vary somewhat in their behavior in different soils. In strong, heavy soils grapes usually succeed better if set at a greater distance and may be allowed to carry more old wood than when they are grown in poor, light soils.

Upon the form of the trellis used will depend to a considerable extent the necessities of the pruning. Four systems that are most used are: Four arm, Kniffen; six arm, Kniffen; Fan system, and Munson system. For the hardier varieties of the American grapes the two-wire, four-cane trellis is quite largely used. When the plants are set they are cut back to one or two buds, but the growth the first year does not require a trellis. The great point to be secured is as large a growth of strong vine as possible. The succeeding spring one of the canes should be left for training to the trellis and at the lower wire one or two canes are left to form horizontal arms upon which the fruit may be borne the following season. Any bunches of grapes that develop the first year should be sacrificed to promote the greater strength of the vines. If a vine is strong the second year the arms may be trained upon the second wire, but in many cases one pair of arms will be all the vines will mature during the second year's growth. The following season the pruning will be restricted to the cutting back of the preceding year's growth upon the second wire, and after these arms are well established the pruning will consist of cutting back the year's growth, leaving out a few buds. Subsequent pruning should be to remove all wood except sufficient wood along these arms to produce a maximum crop of fruit. The number of buds left varies with the locality, variety and strength of the vine, and the market for which the fruit is intended. Growers differ in their opinion as to the number of buds to be left, some cutting back as close as 25 or 30 and others leaving double that number. In sections liable to late frosts a larger number of buds are left than where the climatic conditions are more equable, then if the first shoots are killed by frost others will be produced on the slower buds and a fair crop may be produced.

The six arm system is similar to that of the four arm with the exception that three wires and six arms are used. It is suited for varieties that make a very rank growth and for vines that are growing in very strong soil.

The half hardy varieties, which include most of the hybrid grapes, are best grown upon a fan trellis. This system consists in training from four to six arms over the wires so that they resemble a fan. This system has a minimum of old wood but offers considerable inconvenience in picking because the fruit is borne so low on the vines. The fruit is not so well colored in this system as in some of the other systems. Old stems should be removed each year and new canes trained by heading back as advised for the starting of the vines.



Fan Trellis.

Fig. VI Five foot post Eighteen inches between wires. Vine pruned

The Munson system, sometimes called the overhead system, has a different form of trellis. In this system the posts are four or five feet high and cross arms 18 inches to 2 feet long are nailed to the top. Holes are bored in the cross arms and the wires are stretched through these holes for support of the vines. The third wire may be stretched either above or below at the same level as the wires that extend through the cross arms. The vine is trained to this middle wire and the canes are trained out to either of the side wires. This system gives some advantage over the others in the amount of surface that is exposed to the sunlight. It is very easy to pick the fruit and cultivation can be carried on very easily.

Another system that is sometimes used on hillsides or uneven ground where it is difficult to maintain post and wire trellises is the post and arm, or umbrella, system. This consists of a post and two cross arms. In this system the first and second seasons' growth is devoted to getting strong canes trained to the top of the post, and the secondary vines are then trained over the cross arms. The pruning consists of cutting back the vines to such a number of buds as conditions indicate the vine will be able to support.

The pruning of the grape may be done any time from fall to spring after the leaves have fallen and before the buds begin to swell. If pruning is deferred until the buds swell the vines will bleed badly, but most growers would prefer that the vines should suffer some loss in plant food than to leave them untrimmed. Summer pruning should consist only in cutting back superfluous vines and leaves in order that the strength of the plant may be given to the fruit. In the fan system care must be taken that new canes are provided for the succeeding year's crop, and these should be as near the ground as possible. These may be cut back from four to six feet in length, and this will materially help to ripen the wood. Other vines may be cut back rather severely, but care must be taken to leave sufficient leaf surface to protect the fruit from the sun and the birds, remembering also that a considerable amount of leaf surface is necessary for the production of food material for the growth of the fruit and vines. Summer pruning may also be so severe that it will seriously check the growth of the fruit.

Vines that have been neglected for several years offer a problem that is comparable to a neglected fruit tree. Such vines will require considerable judgment to decide whether it is better to lose a year's crop in order to get the vine back in condi-

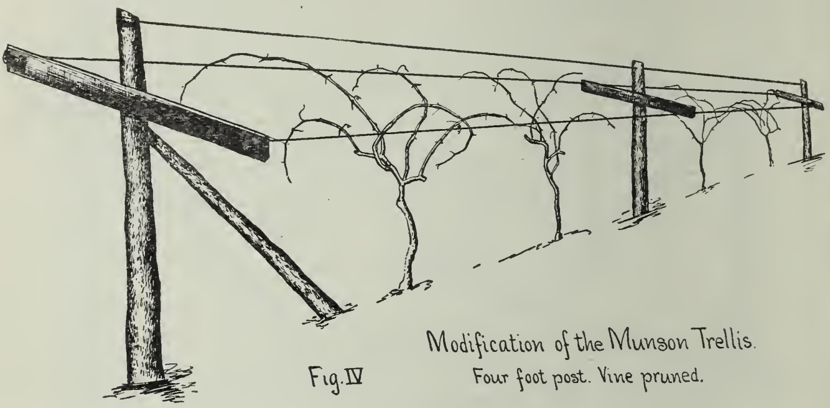
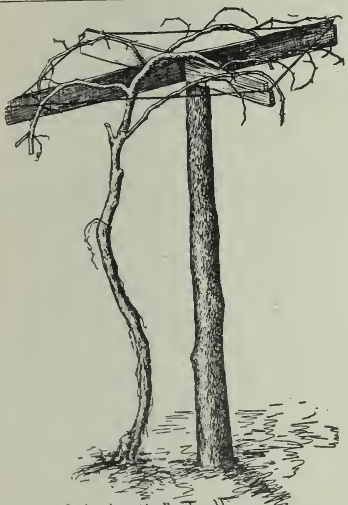


Fig. IV

Modification of the Munson Trellis.

Four foot post. Vine pruned.

tion for successful bearing or whether the vines may be so pruned as to give a crop of fruit during that season and get it into condition for the succeeding year. Neglected vines will always be found to have the fruit bearing wood far from the roots and from the source of food supply. Many times growers will find it is advisable to cut them back close to the ground and start all over again.



"Umbrella" Trellis.
Fig. V Four foot post. Vine pruned.

BUSH FRUITS

Bush fruits may be divided into two groups as regards their pruning requirements. Gooseberries and currants produce their fruit on wood that is more than one year old. In pruning it is the object to secure all lateral branches on wood that is older than one year. Since the fruit is borne on large buds or short spurs, care must be taken to retain these in any pruning. Many times these plants are unproductive because they make such a heavy growth of new wood each season that the fruit buds or spurs do not form on the older wood. During the summer they should be pinched back as indicated.

In the case of brambles, including the raspberry, red raspberry, black berry and dew berry, the fruit is borne on one-year-old wood. As soon as the cane has borne its crop of fruit its usefulness is ended and it may be removed at any time. As a matter of fact, most of the pruning on commercial plantations is done during the winter following, for the removal of canes from a bramble patch during August or September is not an agreeable task. In case the canes are badly infested with disease their early removal is advisable. Summer pruning is usually restricted to cutting back new growths just before the picking season. This checks the growth of the canes and encourages lateral branches to form, which increases the amount of bearing wood and also affords better conditions for the movement of the pickers.

The number of stems should be regulated at this time and from five to six of the strongest shoots should be selected. The other shoots should be removed, so that the selected canes may develop properly.

The winter or late spring pruning should consist of heading back all of the laterals that have formed on the selected canes. These are cut back to 12 to 20 inch spurs, depending on the growth of the plant. This removes the weakest and poorest buds and is the cheapest and most effective method of thinning.

The time for doing this work varies with different growers, but it is a good practice to wait until the most severe winter weather is passed.

If the old canes were not removed in the summer they should be removed in the spring. For this work, either long handled shears or a grape hook will be necessary, for the work is made less disagreeable in this way. For the summer and spring pruning, the pruning shears advised for use in orchards will also be found best adapted for this work.

APRIL, 1915. CIRCULAR NO. 50.

AGRICULTURAL EXPERIMENT STATION.

KANSAS STATE AGRICULTURAL COLLEGE.

FEED AND LIVE-STOCK REMEDY, CONTROL SECTION.

Kansas Live Stock Remedy Law, with List of Remedies Registered April 1, 1915.

When the Feeding-Stuffs Law was first passed, in 1907, an effort was made to bring all "medicated stock foods" and products of like character under the provisions of the law; this was especially declared in the amendment of 1908. After more than five years' trial this arrangement had proven so unsatisfactory that the legislature of 1913 made these products, together with all other remedies used internally for the treatment of live stock, the subject of a separate law. The Live-Stock Remedy Law went into effect July 1, 1913. The text of the law has been published in pamphlet form and given wide circulation. It may also be found in the Session Laws of 1913. We give herewith an abstract showing as briefly as possible the requirements of the law:

Live Stock Remedy Law.

Chapter 187, Session Laws of 1913.

RELATING TO THE MANUFACTURE AND SALE OF MEDICINAL STOCK FOODS AND REMEDIES.

PURPOSES OF THE LAW.

1. To give the purchaser of a live-stock remedy a knowledge of the ingredients in the material purchased.

2. To disclose the composition of all remedies that are composed principally of cheap "fillers."

3. To protect the manufacturer and dealer from the unfair competition of fraudulent or worthless goods.

The term "live-stock remedy," as used in the law, includes all condimental feeds, medicated stock foods, condition powders, conditioners, animal regulators, proprietary medicines, or any preparation of like nature, in either solid or liquid form, designed for any animal except man, and administered internally.

All live-stock remedies, as defined above, for internal use must be registered with the director of the Experiment Station of the Kansas State Agricultural College at Manhattan, Kan. The application for registration must be a sworn statement, giving the English name of each ingredient contained in the remedy, also the actual percentages of any of the following substances: mineral acids; the following elements or their salts: copper, mercury, arsenic, antimony, and phosphorus; the following substances or any of their derivatives or preparations: opium, belladonna, nux vomica, pilocarpus, santonin, areca nut, wormwood, digitalis, strophanthus, calabar bean, aconite, veratrum, croton oil, ergot, cotton-root bark, and cantharides. The maximum percentage of "filler," including such substances as common salt, charcoal, sulphur, earth, humus, elevator dust, or other like substances, must also be shown.

Every sack, box, carton or other package of live-stock remedy sold in the state of Kansas must bear a label or tag showing:

1. The name and principal address of the manufacturer.
2. The name, brand or trade-mark under which the remedy is sold.
3. The English name of each ingredient used in the manufacture of the remedy, together with the percentages required in the application.

The package must also bear a tax stamp or tag, which the manufacturer is required to purchase, to show the payment of a tax of two cents per hundred pounds or pints. Stamps or tags are made in denominations of five, ten, fifteen, twenty, twenty-five, thirty, fifty, and one hundred pounds.

Payment for tags or stamps must be forwarded to the director of the Experiment Station of the Kansas State Agricultural College at Manhattan, Kan. It is then paid into the state treasury each month, and is used for the purpose of enforcing the Live-Stock Remedy Law.

A live-stock remedy can not be registered under a name, brand or trade-mark that is misleading or deceptive, or under a label that does not truthfully state the materials of which it is composed. When the manufacturer has registered a remedy no other person will be required to register it.

The enforcement of the Live-Stock Remedy Law is placed in the hands of the director of the Experiment Station of the Kansas State Agricultural College at Manhattan, Kan., and either he or his authorized deputy shall have free access to all places of business, and shall have the power and authority to open any parcel of whatsoever kind used in the manufacture and sale of live-stock remedies for the purpose of making inspection of such remedies.

Representative samples of each brand of live-stock remedy sold or offered for sale in the state of Kansas shall be taken by the director of the Experiment Station of the Kansas State Agricultural College at Manhattan, Kan., or by his authorized deputy, for inspection and analysis. These representative samples shall be the unbroken orginal packages whenever practicable.

The facts concerning the violations of the Live-Stock Remedy Law shall be certified by the director of the Experiment Station to the proper prosecuting attorney, and in all prosecutions the certificate of analysis or examination, duly sworn to by a person authorized to make such analysis or examination, shall be *prima facie* evidence of the facts certified to such prosecuting officer.

The penalty for the violation of the Live-Stock Remedy Law is a fine of not to exceed one hundred dollars ($100) for the first offense and not less than one hundred dollars ($100) for each additional offense; all penalties recovered to be paid into the school fund of the county where the offense is committed.

The Live-Stock Remedy Law is not a law intended to raise revenue. The rate of tax (2 cents per hundred pounds or pints) is so small that no manufacturer can reasonably complain of the tax being burdensome. Hence no manufacturer need hesitate to meet the requirements of the law unless the plain statement upon the label of the ingredients used makes it impossible for him to persuade the consumer to buy his goods. In such cases the consumer is simply getting the protection he justly deserves.

Some of the manufacturers have simply failed to comply with the law; a few have positively refused to comply, and have withdrawn their remedies from sale in this state. The live-stock remedies produced by these manufacturers are barred from sale in the state until the manufacturers meet the requirements of the law. The names of those refusing to register are given below, together with the names of the remedies formerly offered for sale by them:

S. R. Feil Company, Cleveland, Ohio. Sal-Vet.

Fleming Brothers, Chicago, Ill. Tonic Heave Remedy; Colic Cure.

Giles Remedy Company, Chicago, Ill. Magic Lotion and Blood Purifier.

H. Clay Glover, New York City, N. Y. Full line of remedies.

Humphrey's Homeopathic Medical Co., New York City, N. Y. Entire list of veterinary remedies.

Ransdell's Stock Food Co., Clay Center, Kan. "Make Em Lay" Poultry Food.

John Robbins, Greensburg, Ind. Sal-Tone.

United Drug Company, Boston, Mass. Entire list of Elkay remedies.

A number of remedies in which common salt is the principal ingredient have been withdrawn from sale in the state, because the Live-Stock Remedy Law requires the manufacturers to state on the label the maximum percentage of salt used. Poultry remedies composed of shorts and a small amount of Epsom salts are no longer found on sale, simply because the manufacturer refuses to so label his goods as to tell his customers what they are getting. No customer would willingly pay at the rate of $22.50 per hundredweight for wheat shorts containing a little Epsom salts. No live-stock remedy which complies with the law will be denied the privilege of sale in Kansas, and the remedies hereafter offered for sale will be sold upon their merits, as each package will be labeled to show the ingredients and net weight.

CONCENTRATED LYES.

The class of remedies which have heretofore been sold in the state, such as Merry War Lye and other concentrated lyes offered for sale as live-stock conditioners and cures for various animal diseases, are also brought under the provisions of the Live-Stock Remedy Law, and in all cases where these products are offered or exposed for sale as live-stock remedies for internal use they must state on the outside of the package the net weight and the various ingredients. Such investigations as have been conducted do not seem to bear out the claims made as to the value of these so-called remedies. Directions for feeding shown on the cans advise the same dosage and advertising claims the same curative action on brands of lye varying in purity from 98 per cent to 77.25 per cent. The directions often printed on the can show the use of from one-fourth to one-half a can to one barrel of water. The standard barrel of water containing 6400 ounces, and the ordinary can of lye containing 12 ounces, the results of the combination, to say the least, would be doubtful, while the results from the use of lye in increased strength has, in many cases, proved fatal. This product, if classed as a remedy, might be used as an alkaline in cases of sour stomach and similar ailments. As a vermifuge we can find no proof that it is at all satisfactory. A little consideration of this matter will raise a doubt in the mind of any person as to the curative properties of concentrated lye.

It should be borne in mind at all times that there are no "cure-alls" among live-stock remedies any more than among remedies for human beings. Unless the owner of an animal is sure of his diagnosis, the safest and best plan is for him to employ a competent veterinarian, whose advice should be followed.

We give below some of the ingredients usually found in live-stock remedies. The list shown contains a number of the drugs commonly used in veterinary medicines, with their common names, and indicates the general effect these drugs may have. This list is in no sense intended to be a condensed "materia medica." It should be borne in mind that the list given is not intended as a recommendation of any remedy or class of remedies. These drugs have the effects shown, and may also have other effects. Nearly all drugs are more or less poisonous when given in large doses. In combination with other drugs, the effect of any of them may be altered. The action indicated, however, will be applicable in most cases and will add to the information that the statement of the various ingredients of the remedy, as shown on the label, is intended to give.

Acacia.—Demulcent.
Aconite.—Depressant.
Aloes.—Cathartic.
Aloin (see Aloes).—Purgative.
Alum.—Powerful astringent.
American Wormseed.—Anthelmintic.
Antimony (sulphurated).—Emetic.
Antimony trisulphide (see Antimony).
Aniseed.—Aromatic; carminative.
Areca nut.—Anthelmintic.
Arsenic (poison).—Tonic.
Asafetida.—Stimulant; antispasmodic.

Belladonna.—Sedative; stimulant.
Bismuth subnitrate.—Sedative; astringent.
Bicarbonate of soda.—Alkaline.
Bittersweet.—Increases secretions of kidney and skin.
Bloodroot.—Emetic.
Bone ash.
Bryonia.—Hydragogue; cathartic.
Buchu.—Kidney ailments.
Calomel (mercurous chloride).—Purgative.
Camphor.—Local; cooling; astringent; stimulant.
Cannabis, American (Indian hemp; American hemp).
Cannabis indica (Indian hemp).
Cantharides.—Blister; counter-irritant.
Capsicum.—Local stimulant.
Caraway.—Stomachic; corrective.
Carbolic acid (phenol).—Antiseptic; irritant.
Carbonate of iron.
Carbonate of soda.—Alkaline.
Cascarilla.—Aromatic; tonic.
Cascara sagrada.—Laxative.
Castor oil.—Cathartic.
Charcoal.—Absorbent.
Chloroform.—Anesthetic; counter-irritant and narotic.
Cinchona bark (Peruvian bark).—Tonic; febrifuge.
Columbo.—Mild bitters; tonic.
Copperas (ferrous sulphate).—Astringent; chalybeate.
Copper sulphate (blue vitriol).—Stimulant; astringent; escharotic.
Coriander.—Aromatic.
Creosote.—Germicide.
Cresol (see Creosote).
Dandelion.—Tonic; aperient; diuretic.
Digitalis.—Circulation stimulant; diuretic.
Elecampane.—Tonic.
Epsom salts (magnesium sulphate).—Cathartic; diuretic.
Fenugreek.—Emollient.
Gentian.—Tonic; bitters.
German wormseed meal (see Levant wormseed).
Ginger.—Stimulant; carminative.
Glauber salts (sodium sulphate).—Cathartic.
Glucose.—Condiment; nutritive.
Golden seal.—Increases secretion of bile.
Guaiacol (see Creosote).
Hemlock oil.
Horse medley (commercial antimony).—Composition principally powdered coal; doubtful value.
Hyposulphite of soda. (Intestinal antiseptic.)
Indian hemp (hashish).—Powerful narcotic.
Iron sulphate (ferrous sulphate).—See Copperas.
Juniper berries.—Stimulant; diuretic.
Lavender, Compound tincture of.—Nausea.
Levant wormseed.—Vermicide; little used.
Licorice root.—Demulcent; pulmonary; intestinal.
Linseed oil.—Laxative.
Lobelia.—Severe emetic.
Magenta.—Coloring.
Magnesium.—Antacid; laxative.
Magnesium sulphate (see Epsom salts).
Male fern (aspidium).—Tæniacide.
Mandrake.—Cathartic; cholagogue.
Mercurous chloride (see Calomel).
Methyl salicylate (oil of wintergreen).—Flavor.

Milk sugar.—Condiment; nutritive.
Mustard.—Condiment; laxative.
Nitrate of potash (potassium nitrate, saltpeter).—Local; diuretic.
Nux vomica (poison).—Tonic and stimulant.
Oil of bitter almond.—Corrective.
Oil of cinnamon.—Aromatic; carminative.
Oil of eucalyptus.—Stimulant; expectorant.
Oil of fennel.—Carminative; corrective.
Oil of peppermint.—Stimulant; carminative.
Oil of turpentine.—Stimulant; diuretic.
Permanganate of potash.—Disinfectant; germicide.
Pinkroot.—Anthelmintic.
Pine tar.—Stimulant.
Poke root.—Purgative; narcotic.
Poplar bark.—Tonic.
Pumpkin seed.—Tæniafuge.
Quassia.—Tonic; bitters.
Resin.—Kidney.
Rhubarb.—Tonic; stomachic.
Sabadilla.—Drastic emetic; cathartic.
Santonin (active principle of Levant wormseed).—Vermicide.
Saltpeter (see Nitrate of potash).
Sassafras.—Aromatic; narcotic.
Senna.—Purgative.
Sodium chloride (common salt).
Sodium sulphate (see Glauber salts).
Spanish brown (ochre).—Coloring.
Starch.—Nutritive.
Stramonium (similar to belladonna).
Sulphate of soda (see Glauber salts).
Sulphur.—Laxative; diaphoretic.
Sulphuric ether.
Tartar emetic.—Emetic; expectorant; diaphoretic.
Tartaric acid.
Tobacco.—Narcotic; vermifuge.
Venetian red.—Coloring.
Wild cherry bark.—Tonic; doubtful.

List of Firms Registering Live-Stock Remedies.

The following list gives the names of all firms registered in Kansas, together with the names of remedies registered by each:

The Abbott Alkaloidal Company, Chicago, Ill.:
- Abbott's Chicken Cholera Remedy for Poultry.

Antisecrete Manufacturing Company, Sabetha, Kan.:
- Antisecrete.

S. F. Baker & Company, Keokuk, Iowa:
- Baker's Condition Powder.

The Dr. S. E. Ball Medical Company, Fort Scott, Kan.:
- Hog Cholera Remedy.
- Hog Lung Remedy.
- Poultry Tonic.
- Stock Tonic.
- Veterinary Colic Remedy.
- Veterinary Kidney Remedy.
- Veterinary Physic.

Barber Medicine Company, Kansas City, Mo.:
- Barber's Hog Powder.

Beauchamp Manufacturing Company, Holton, Kan.:
- Beauchamp's Distemper Remedy.

The Binkley Medical Company, Nappanee, Ind.:
- Frazier's Distemper Remedy.

The Blackman Stock Remedy Company, Chattanooga, Tenn.:
- Blackman's Medicated Salt Brick.
- Char-Med-Sal.
- Ideal Poultry Tablets.
- Owen's Health and Egg Producer.

J. H. Brown & Company, Atchison, Kan.:
- Alcorn's Chicken Cholera Powder.

Callahan Manufacturing Company, Omaha, Neb.:
- Champion Horse Conditioner.
- Champion Worm Expeller.

The Capitol Food Company, Tiffin, Ohio.
- Salvago.

R. R. Clutz, Bendena, Kan.:
- Kansas Hog Tonic.

Columbian Hog and Cattle Powder Company, Kansas City, Mo.:
- Columbian Stock Powder.

The G. E. Conkey Company, Cleveland, Ohio:
- Conkey's Bronchitis Remedy.
- Conkey's Chicken Pox Remedy.
- Conkey's Cholera Remedy.
- Conkey's Laying Tonic.
- Conkey's Limber Neck Remedy.
- Conkey's Poultry Tonic.
- Conkey's Roup Remedy.
- Conkey's Starting Food (For Chicks).
- Conkey's Stock Tonic.
- Conkey's White Diarrhœa Remedy.

L. L. Constant, Belle Plaine, Kan.:
- Government Hog Powder.

Albert Cure & Son, Atchison, Kan.:
- Poultry Powder.
- Poultry Zone.
- Stock Powder.

The Dairy Association Company, Lyndonville, Vt.:
- Kow Kure.
- Grange Garget Remedy.
- American Horse Tonic.

Dr. A. C. Daniels, Inc., Boston, Mass.:
- Dr. A. C. Daniels' Cow Invigorator.
- Dr. A. C. Daniels' Horse Renovator Powders.
- Dr. A. C. Daniels' Worm Killer Powders.
- Dr. A. C. Daniels' Cough, Cold, Fever and Distemper Drops.
- Dr. A. C. Daniels' Colic Drops.

The Dent Medicine Company, Newburg, N. Y.:
- Dent's Diarrhœa Pills.
- Dent's Cholera Remedy.
- Dent's Condition Pills.

Dent's Blood Pills.
Dent's Distemperine.
Dent's Vermifuge.
Dent's Tape Worm Remedy.
Dent's Laxative.

C. W. Dougherty Manufacturing Company, Kansas City, Mo.:
Kellerstrass Roup Remedy.
Kellerstrass Cholera Remedy.
Kellerstrass Egg-A-Day Tonic.
Kellerstrass Gape Remedy.
Kellerstrass Limberneck Remedy.
Kellerstrass White Diarrhœa Remedy.
Kellerstrass Chicktone.

Douglas & Son, Manhattan, Kan.:
Success Stock Powder.
Success Poultry Tonic.

The Economy Hog and Cattle Powder Co., Shenandoah, Iowa:
Economy Stock Powder.

The Electric Medical Company, Ashland, Kan.:
Electric Stock Tonic.

Emmert Proprietary Company, Chicago, Ill.:
Uncle Sam's Condition Powder.

Farmer's Hog and Cattle Powder Company, Tecumseh, Neb.
Farmers' Stock Powder.
German Hog Remedy.

The Farmer's and Manufacturer's Remedy and Supply Company, Kansas City, Mo.:
Wright's Hog Health.

The Federal Stock Food Company, Mifflinburg, Pa.:
Federal Stock Tonic.
Federal Poultry Tonic.

J. J. Fleck, Tiffin, Ohio:
Fleck's Poultry Powder.
Fleck's Stock Powder.
Fleck's Condition Powder.
Fleck's Hog Remedy Worm Powder.
Fleck's Heave Remedy.

The F. & K. Remedy Company, Arkansas City, Kan.:
F. K. (For White Diarrhœa and Cholera).

Dr. S. C. Freeland, D. V. S., Marion, Kan.:
Freeland's Alterative Powders.
Freeland's Colic Remedy.

Furst-McNess Company, Freeport, Ill.:
F. W. McNess Poultry Tonic.
F. W. McNess Sal-Tonic (A Medicated Stock Salt).
F. W. McNess Stock Tonic.

The German Distemper Remedy Company, Goshen, Ind.:
German Distemper Remedy.

The Germo Manufacturing Company, Sedalia, Mo.:
Cholerine.

B. Goodwin, Topeka, Kan.:
Goodwin's Poultry Remedy.

The Goshen Distemperine Company, Goshen, Ind.:
  Distemperine.

J. W. Grauerholz, Kensington, Kan.:
  Jim's Germicide.

E. E. Gray, Protection, Kan.:
  Gray's Condition Powders.

Ed. F. Haberlein, McPherson, Kan.:
  Dog Distemper Remedy.
  For Worms.
  Condition Pills.
  Distemper Pill (Part of Distemper Treatment).
  Eczema Pill (Part of Ezema Treatment).
  Tonic Pills.

Haller Proprietary Company, Blair, Neb.:
  Condition Powder.
  Hog Worm Powder.
  Poultry Powder.
  Stock Powder.

The Hamilton Drug Company, Atchison, Kan.:
  Government Hog Cholera Powder.
  Hamilton's Hog Health.

The Hammer Remedy Company, Lamoni, Iowa:
  Inomal White Diarrhœa Remedy.

J. B. Hampton, Colby, Kan.:
  Sunflower Stock Powder.

Joe Heavenridge, Canon City, Colo.:
  Cholera Put-Us-On-The-Hog.

Dr. Hess & Clark, Ashland, Ohio:
  Dr. Hess Stock Tonic.
  Dr. Hess Worm Powder.
  Dr. Hess Hog Worm Powder.
  Dr. Hess Poultry Panacea.
  Dr. Hess Heave Powder.
  Dr. Hess Distemper, Fever and Cough Remedy.
  Dr. Hess Colic Remedy.
  Dr. Hess Roup Remedy.

The International Stock Food Company, Minneapolis, Minn.:
  International Medicinal Poultry Food Tonic.
  International Medicinal Stock Food Tonic.
  International Sulpho Salts.
  International Heave Remedy.
  International Colic Remedy.
  International Hog Worm Remedy.
  International Worm Remedy.
  International Distemper Remedy.

T. H. Jackson & Company, Quincy, Ill.:
  T. H. Jackson's Common Sense Renovating Powders.
  T. H. Jackson's Common Sense Colic Remedy.

J. & H. Medical Company, Colony, Kan.:
  J. & H. Distemper Remedy.

F. E. Johnson & Company, Pierce City, Mo.:
  Maggie's Poultry Medicine.

Kalo Stock Remedy Company, Quincy, Ill.:
    Hog Tonic.
    Medicated Brick.
    Medicated Salt.
    Poultry Tonic.
    Sheep Tonic.
    Steer Tonic.

The Kansas City Sanitary Company, Kansas City, Mo.:
    Eureka Stock Powder.

The Kansas City Veterinary Remedy Company, Kansas City, Mo.:
    Scientific Minerals, Herbs and Roots.

The Kansas Kolera Kure Company, Hutchinson, Kan.:
    The Kansas Kolera Kure.

The King Company, Rockford, Ill.:
    King Poultry Powder.
    King Stock Tonic.
    King Veterinary Colic Remedy.
    King Veterinary Worm Remedy.

I. J. Kinyon, Bern, Kan.:
    Concentrated Hog Powders.

K. K. K. Medicine Company, Keokuk, Iowa:
    Dr. Machin's K. K. K. Condition Powder Regulator.

The Kraum Remedy Company, Emporia, Kan.:
    Kraum's Poultry Powder.
    Kraum's Condition Powder.
    Kraum's Cholera and Roup Remedy.

George H. Lee Company, Omaha, Neb.:
    Lee's Best Conditioner.
    Lee's Egg Maker.
    Lee's Hog Remedy.
    Lee's Stock Tonic.
    Lee's Worm Powder.

H. W. Loveland, Wichita, Kan.:
    Doc. Loveland's Remedy for White Diarrhœa in Little Chicks.

Mrs. Nancy McGraw, Fort Scott, Kan.;
    Dr. McGraw's Colic Cure.

The McPike Drug Company, Kansas City, Mo.:
    Government Hog Cholera Remedy.

Menke & Company, Kansas City, Mo.:
    Chickena.
    Lion Brand Stock Powder.

W. H. Metzger Manufacturing Company, Quincy, Ill.:
    Egge.

Miller Drug Company, Junction City, Kan.:
    Goings Condition Powder.

Missouri Grocery Company, Kansas City, Mo.:
    Chick-A-Tone.

Monarch Chemical Company, Wichita, Kan.:
    Sure Shot Stock Powder.

James L. Murray, Coldwater, Kan.:
    Keystone Colic Cure.

National Chemical Company, Burlington, Iowa:
- Dr. Miller's "Lucky Strike" Poultry Tonic.
- Dr. Miller's "Lucky Strike" Stock Tonic.

The O. S. Hog Remedy Company, Tonkawa, Okla.:
- O. S. Hog Remedy.

Old Kentucky Manufacturing Co., Paducah, Ky.:
- B. A. Thomas' Imp. Hog Powder.
- B. A. Thomas' Imp. Stock Remedy.
- B. A. Thomas' Imp. Poultry Remedy.

Olephan Chemical Company, Wamego, Kan.:
- F. S. H.

The Omaha Remedy Company, Omaha, Neb.:
- Omaha Remedy Cattle Powders.
- Omaha Remedy Hog Powder.
- Omaha Remedy Horse Powders.
- Omaha Remedy Poultry Powder.
- Omaha Remedy Special Hog Powder (Prepared for Sick Hogs).

Paxton-Eckman Chemical Company, Omaha, Neb.:
- P-E Regular Powder.
- P-E Poultry Powder.
- P-E Special Hog Powder.
- P-E Special Horse Powder.

The Peerless Stock Powder Company, Falls City, Neb.:
- Peerless Stock Powder.

Pioneer Stock Dip and Remedy Company, Kansas City, Mo.:
- Conditioner and Worm Expeller.
- Horse Conditioner and Worm Expeller.

Pratt Food Company, Philadelphia, Pa.:
- Pratt's Animal Regulator.
- Pratt's Baby Chick Food.
- Pratt's Bronchitis Remedy.
- Pratt's Conditioner for Horses and Cattle.
- Pratt's Condition Powder.
- Pratt's Condition Tablets.
- Pratt's Colic Remedy.
- Pratt's Cow Tonic.
- Pratt's Chicken Cholera Remedy.
- Pratt's Distemper Remedy.
- Pratt's Gape Remedy.
- Pratt's Heave Remedy.
- Pratt's Hog Cholera Specific.
- Pratt's Hog Worm Powder.
- Pratt's Poultry Regulator.
- Pratt's Roup Remedy (Powder Form).
- Pratt's Roup Remedy (Pill Form).
- Pratt's Sore Head Chicken Pox Remedy.
- Pratt's White Diarrhœa Remedy.
- Pratt's Worm Powder.

The Premium Chemical Company, St. Joseph, Mo.:
- Government Hog Cholera Remedy.

The Prussian Remedy Company, St. Paul, Minn.:
- Poultry Tonic.
- Stock Tonic.
- Vermo-Salto.
- Colic Killer.

Roup Remedy.
Hog Worm Powder.
Horse Worm Powder.
Horse Tonic.
Calf Tonic.

The W. T. Rawleigh Medical Co., Freeport, Ill.:
Rawleigh's Colic and Bloat Remedy.
Rawleigh's All Medicine Hog Mixture.
Rawleigh's Cough and Heave Remedy.
Rawleigh's All Medicine Stock Mixture.
Rawleigh's Poultry Powder.
Rawleigh's Stock Tonic.

John Reese, Newton, Kan.:
Reese's Condition Powder.
Reese's Poultry Powder.

T. J. Ritner, Atchison, Kan.:
Ritner's Mustard Bran.

David Roberts Veterinary Co., Waukesha, Wis.:
Breeding Tonic.
Calf Cholera Remedy.
Calf Meal.
Colic Drench.
Cow Cleaner.
Cow Tonic.
Fever Paste.
Heave Powder.
Hog Tonic.
Horse Tonic.
Kidney Aid.
Laxotonic.
Physic Balls.
Poultry Cholera Medicine.
Poultry Tonic.
Roup Paste (Poultry).
Sheep Tonic.
Stock Vigor.
Worm Powder.

Alex Roese, McCune, Kan.:
Roese's Chicken Cholera Remedy.
Roese's Roup Remedy, Egg and Health Promoter.

Salt-Lode Manufacturing Co., Baldwin, Kan.:
Salt-Lode.

A. J. Sauer, Wichita, Kan.:
Improved Condition Powder.

The Scarless Remedy Company, Winterset, Iowa:
Scarless (Brand) Vi Tone.
Scarless (Brand) White Diarrhœa and Cholera Remedy.
Scarless (Brand) Poultry Tonic.
Scarless (Brand) Stock Tonic.
Scarless (Brand) Roup and Cholera Specific.
Scarless (Brand) Hog Worm Destroyer.

Scientific Stock Raisers Medical Ass'n, Kansas City, Mo.:
Scientific Minerals, Herbs and Roots.

Security Remedy Company, Minneapolis, Minn.:
Condition Powder for Horses and Mules.
Cough, Cold and Distemper Remedy.
Security Calf Food.
Security Poultry Powder.
Security Stock Powder.
Security Worm Powder.
Ton-Vermi.

Scott-Lanyon Cash Drug Co., Pittsburg, Kan.:
Prescription No. 40,300.

The A. B. Seelye Medical Co., Abilene, Kan.:
- Seelye's Golden Belt Stock Tonic.
- Seelye's Universal Condition Powder.

The Shreve Drug Company, White Cloud, Kan.:
- No. 79 Colic Remedy.

Sipe Conditioner Manufacturing Co., Hiawatha, Kan.:
- Sipe's Guaranteed Stock Conditioner.
- Sipe's Guaranteed Hog Conditioner.
- Sipe's "Noxigerm" (A Poultry Remedy).

C. Skelding, Fort Scott, Kan.:
- American Stock Food or Condition Powder.

Dr. Earl S. Sloan, Inc., Philadelphia, Pa.:
- Sloan's Horse Powder.
- Sloan's Anti-Colic.
- Sloan's Worm and Tonic Powders.
- Sloan's Fever and Distemper Tonic.

Dr. D. C. Snoddy Co., Nashville, Tenn.:
- Snoddy's Hog Cholera Powder.

The Dr. J. H. Snoddy Remedy Co., Alton, Ill.:
- The Snoddy Remedy for Hogs and Poultry.

The Standard Chemical Manufacturing Co., Omaha, Neb.:
- Standard Hog Regulator.
- Standard Horse and Cattle Regulator.
- Standard Poultry Tonic.
- Standard Milk Meal.
- Standard Stock Food.

Steel's Hog Remedy Company, Sabetha, Kan.:
- Steel's Hog Remedy.

T. Stevens, Hiawatha, Kan.:
- Horse Colic Cure.

Stock Food Company of America, Minneapolis, Minn.:
- Clover Brand Stock Tonic.
- Clover Brand Poultry Tonic.
- Clover Brand Worm Powder.

The W. R. Talbott Chemical Company, Sandusky, Ohio.:
- Sal-Medico.

Clarence Teeter, Huron, Kan.:
- "Little Dick's" Germ Killer.

Clif. E. Thompson, Kansas City, Mo.:
- Thompson's "Anti-Kolera."

Ungles Hoggette Manufacturing Co., Lincoln, Neb.:
- Ungles' Hoggette.

Union Stock Yards Company of Omaha, South Omaha, Neb.:
- Grain Belt Brand Vegetable Hog Potash.

The Victor-Cooper Co., Downs, Kan.:
- Cooper's Antizymotic Alfalfa Bloat and Colic Remedy.
- Cooper's Anti-Spasmodic Colic Remedy.
- Cooper's Equine Tonic Solution of Potassium Arsenite.
- Cooper's Antiseptic Liniment.
- Silotone Stock Powder.

Victor Manufacturing Company, Spring Hill, Kan.:
- Victor Germ Arrestor.
- Victor Oil.
- Victor Swine Conditioner.

- Walker Remedy Company, Lamoni, Iowa:
  - Walker Roup and Cholera Remedy.
  - Walko Tonix.
- S. J. Ward, Sylvan Grove, Kan.:
  - Ward's Condition Powder.
- The J. R. Watkin's Medical Co., Winona, Minn.:
  - Watkin's Poultry Tonic.
  - Watkin's Stock Tonic.
- Weetman & Weetman, Topeka, Kan.:
  - Poultry Tonic.
- The Western Buyers' Association, Kansas City, Mo.:
  - W. B. A. Condimental Stock Food.
  - W. B. A. Poultry Food.
- The Western Stock Remedy Company, Lawrence, Kan.:
  - Farmers' Union Stock Tonic.
- The Wherrett-Mize Drug Co., Atchison, Kan.:
  - Government Hog Powder.
- The Wilbur Stock Food Company, Milwaukee, Wis.:
  - Wilbur's Calf Meal.
  - Wilbur's Cough, Cold and Distemper Remedy.
  - Wilbur's Gas Colic Cure.
  - Wilbur's Heave Remedy.
  - Wilbur's Hog Tonic.
  - Wilbur's Pink Eye Remedy.
  - Wilbur's Pure Medicated Salt.
  - Wilbur's Stock Tonic.
  - Wilbur's Poultry Tonic.
  - Wilbur's Worm Powder.
- C. H. Wintersteen, Cameron, Mo.:
  - Barnett Stock Remedy.
  - Save the Horse Wonder Powder.
- W. F. Young, P. D. F., Springfield, Mass.:
  - Young's Kidney and Nerve Powders.
  - Young's Fattening and Condition Drops.
- R. E. Zimmerman, Troy, Kan.:
  - Troy Stock Powder.

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APRIL 15, 1915. CIRCULAR NO. 51.

AGRICULTURAL EXPERIMENT STATION.

KANSAS STATE AGRICULTURAL COLLEGE.

DEPARTMENT OF POULTRY HUSBANDRY.

Improving The Kansas Egg.

WM. A. LIPPINCOTT.

"GRADE THOSE EGGS" should be the slogan of every person in Kansas in any way interested in poultry production. Grading means more profit for the farmer, a standardized product for shipper, packer and consumer, and a greater outlet for breeding stock.

Producing better eggs is a farm problem. Paying better prices is a dealer's problem. Both are fairly simple. Both require special care. Neither will be fully solved unless the other is solved at the same time.

The production of eggs of the best quality involves considerable pains on the part of the farmer, and the farmer who is not already taking these pains, because he has formed the habit of doing all his work well, will not do so unless he is paid for his trouble. The only way of getting at him is to touch his pocketbook.

At present most of the eggs sold by the farmers throughout the country are purchased on the "case-count" basis, or, at best, "rots out." "Case-count" means that a flat price is paid for all eggs regardless of quality or condition. On the "rots-out" basis the actually rotten eggs are not paid for, but everything else goes.*

Eggs that are small, dirty and stale bring as much money as newly laid eggs that are large and clean. This means that the producer of good goods fails to get his share of the returns.

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* The "rots-out" basis is being rather generally adopted because of the fact that the Kansas food and drugs law, section 7, subdivision 6, under "Foods," provides that "if it [the food product] consists in whole or in part of a filthy, decomposed, tainted or putrid animal or vegetable substance, it shall be considered adulterated." The Kansas State Board of Health has ruled that "this clearly covers the matter of tainted or rotten eggs, and any person or persons, whether farmer or dealer, who sells or offers for sale tainted or rotten eggs is liable to the penalties for selling adulterated foods. This ruling has been upheld in court on numerous occasions, to the discomfiture of both farmers and dealers.

Some one has said that the farmer makes a mistake in selling the goods he produces at wholesale and buying the goods he consumes at retail. He also sells much that he produces on the average price basis, getting the same price whether his goods are superior or inferior. He buys, however, on a graded basis, when he turns in his eggs in trade, whether it is for coffee, calico, or canned goods.

THE BEST PRICE FOR THE BEST EGGS.

In spite of the prevalence of such systems of buying, there are probably more farmers and farmers' wives who are marketing eggs above the average in quality than there are buyers who pay average prices and get eggs below the average in quality. This means that the dealer is not paying a price so high as the quality of the eggs warrants.

The accompanying table shows figures furnished by a Kansas egg buyer. They are taken from his books and represent the eggs purchased direct from farmers during June.

	"Firsts."			"Seconds."			"Firsts" and "Seconds."	
Date.	Dozens.	What they brought at 15½ cents.	What they would have brought at 14 cents.	Dozens.	What they brought at 12½ cents.	What they would have brought at 14 cents.	What they brought at 15½ cents. and 12½ cents.	What they would have brought at 14 cents.
June 1	663	$102.76	$92.82	254	$31.75	$35.56	$134.51	$128.38
June 3	76	11.78	10.64	40	5.00	5.60	16.78	16.24
June 4	80	12.40	11.20	28	3.50	3.92	15.90	15.12
June 5	138	21.39	19.32	35	4.37	4.90	25.76	24.22
June 6	36	5.58	5.04	12	1.50	1.68	7.08	6.72
June 7	100	15.50	14.00	35	4.37	4.90	19.87	18.90
June 8	486	73.33	68.04	170	21.25	23.80	96.58	91.84
June 10	95	14.72	13.30	29	3.62	4.06	18.35	17.36
June 11	195	30.22	27.30	77	9.62	10.78	39.85	38.08
June 12	107	16.58	14.98	53	6.62	7.42	23.21	22.40
June 13	51	7.90	7.14	22	2.75	3.08	10.65	10.22
June 14	169	26.19	23.66	44	5.50	6.16	31.69	29.82
June 15	325	50.37	45.50	108	13.50	15.12	63.87	60.62
June 17	17	2.63	2.38	1	.12	.14	2.76	2.52
June 18	247	38.28	34.58	47	5.87	6.58	44.16	41.16
June 19	120	18.60	16.80	70	8.75	9.80	27.35	26.60
June 20	170	26.35	23.80	60	7.50	8.40	33.85	32.20
June 21	53	8.21	7.42	16	2.00	2.24	10.21	9.66
June 22	434	67.27	60.76	114	14.25	15.96	81.52	76.72
June 24	96	14.88	13.44	18	2.25	2.52	17.13	15.96
June 25	66	10.23	9.24	20	2.50	2.80	12.73	12.04
June 26	72	11.16	10.08	28	3.50	3.92	14.66	14.00
June 27	71	11.00	9.94	22	2.75	3.08	13.75	13.02
June 28	88	13.64	12.32	9	1.12	1.26	14.76	13.58
June 29	470	72.80	65.80	85	10.62	11.90	83.47	77.70
Total	4,425	$685.87	$619.50	1,397	$174.62	$195.58	$860.50	$815.08

On May 31 this dealer was paying 14 cents a dozen and taking everything that was brought in, without reference to quality. On June 1 he began buying on a basis of two grades, which he called "firsts" and "seconds." He paid 15½ cents for the firsts. These were eggs that were of good size, clean, uncracked, and newly laid. He paid 12½ cents for the seconds, or eggs that were small, dirty, shrunken, or cracked. Rotten eggs were discarded and not paid for at all.

It will be noticed by referring to the columns marked "Dozens of firsts" and "Dozens of seconds" that the firsts greatly outnumbered the seconds. There was not a single day in the whole month's business when this did not hold true. In the sum total of the month's business the "firsts" outnumbered the "seconds" more than three to one. This is only a single instance, but it is likely to be true in the majority of cases, and certainly will where quality buying is practiced.

By reference to the columns headed "What they would have brought at 14 cents," on the first day's business, which happened to be Saturday, the difference is found to amount to nearly $10. If these eggs had not been graded, but bought on the flat price, the persons who had taken care of their eggs and brought in the 663 dozen of "firsts" would have gone home with nearly $10 less money than they did go home with. On the other hand, as may be seen by referring to the columns headed "What they brought at 12½ cents" and "What they would have brought at 14 cents," it will be noticed that the persons who brought the 254 dozen second-class eggs went home with nearly $4 less than they would have taken home if they had been selling at the flat price. This is as it should be. The person who sells a poor product would receive a lower price.

QUALITY BUYING ELIMINATES GUESSING.

The difference between the $10 and the $4 comes out of the dealer's pocket. This particular dealer says that he is glad to pay this difference because he gets a larger number of first-class eggs. At the same time he knows exactly what he is getting and does not have to guess at the number of "seconds" or "rots" that he may possibly get, as he did when fixing a flat price. The price is set by the goods and not by guess. The guess is not likely to favor the farmer, as the dealer does the guessing.

There are rules that every farmer who takes pride in selling good eggs at a good price should follow:

First. Use males from a high-laying strain of one standard breed, mate them with hens instead of pullets, and keep up the practice year after year. It is the only way to secure a flock that will lay uniform eggs of good size unless one goes to the expense of getting a pure-bred flock outright. It has been shown by experiment that a "hen" lays a larger egg than the same bird did when she was a pullet, and that "hen" eggs hatch better and produce larger and stronger chicks than "pullet" eggs. Having selected male birds of the breed you prefer, use that breed consistently year after year. Using males from one breed and then another is almost as bad as using mongrels.

NINETY-FIVE PER CENT OF "FIRSTS."

Second. Sell your eggs only to a buyer who candles and grades and who is willing to pay at least 3 cents a dozen more for "firsts" than for "seconds." If your present buyer does not candle, sell to one who does. Some buyers make a difference of 8 cents between "first" and "seconds." The greater the difference the better it is for all concerned. It is possible to market eggs that are more than 95 per cent "firsts" by observing a few precautions.

INFERTILE EGGS KEEP BEST.

Third. Keep the male birds from the laying flock except during the breeding season. If you sell eggs on the quality basis it will pay you for your trouble. Out of 2205 eggs from Kansas flocks that had no male bird present, and that were candled by experts from the United States Department of Agriculture during June, July, and August, 1427, or 63.8 per cent, were first-class eggs. Some of these eggs had been properly cared for and some had not, but all were infertile. Out of 2257 eggs from Kansas flocks that had male birds present these same experts found only 916, or 40.6 per cent, first-class eggs. The conditions in this case were exactly the same as in the first except that there were male birds present, and there was a difference of 23.2 per cent in favor of the infertile eggs.

In money this means that, even if you are not taking particular pains with your eggs, you can, by removing the male bird, make them net you more than two-thirds of a cent a dozen more if you are receiving 3 cents more for "firsts" than for "seconds." Two-thirds of a cent is worth just as much when added to the selling price of the dozen eggs as it is when added to that of a pound of beef or pork on the hoof.

Fourth. Provide roomy, clean nests. There should be at least one nest for every six hens. Foul nests cause dirty eggs. Dirty eggs, no matter how large and fresh, are always graded as "seconds" or lower. It will not do to wash the eggs in trying to make them clean. A washed egg is classed as a "second" because it spoils sooner than an unwashed one.

Dirty nests are generally caused by the fowls roosting on the edge of the nests and allowing droppings to fall in, or by the hens waiting at the edge of their favorite nest for another hen to get through laying, and fouling the side of the nest with droppings as they wait. In the nest illustrated, the sliding door at one end may be shut at night. This will keep the birds from roosting on the nests. The narrow board by which the hens enter the nests allows their droppings to fall on the floor instead of accumulating to soil their feet and then the eggs. The removable board on the front of the nests makes them convenient to clean.

KEEP EGGS AS YOU WOULD MILK.

Fifth. Gather the eggs often, and keep them in a cool, dry place all the time until they are sold. It was found by the government egg expert, while working in Kansas, that out of 385 clean, infertile eggs that were collected twice a day and kept in a cave or cellar that was cool and dry, until they were taken to town, and kept out of the sun on the way to town, 375, or 97.4 per cent, were "firsts" when candled.

At the same time, out of 479 clean but fertile eggs which were allowed to remain in the nests until marketed, only 60, or 13.2 per cent, candled out first class. This is a long way from a perfect record, and is duplicated surprisingly often. Between these two extremes there are differences in degree.

Clean, infertile eggs taken from straw stacks gave only 29.1 per cent first-class eggs. Clean, infertile eggs from under a corn crib gave 70.8 per cent "firsts."

To produce first-class eggs all conditions must be right. Eggs, like milk, should be cooled just as soon as possible after being produced, should be kept cool, and should be marketed as

Courtesy of Bureau of Animal Industry.

PLATE 1. A newly laid egg when broken out.

soon as possible. Like milk and butter, eggs become tainted by odors, and should be kept away from onions, turnips, kerosene, or anything else having an odor.

Sixth. Use the small, dirty or cracked eggs at home. Small eggs are just as wholesome for food as large ones. They can not be sold for so much as large ones, however, for they are not worth so much. Dirty eggs are also good if fresh, but do not look well. Because of this fact they are classed as "seconds." Cracked eggs will mold and spoil quickly. Eggs found in stolen nests are always of doubtful quality. It is better if you use them cautiously at home. By using the small, dirty and doubtful eggs at home it is possible to build up a reputation

Courtesy of Bureau of Animal Industry.

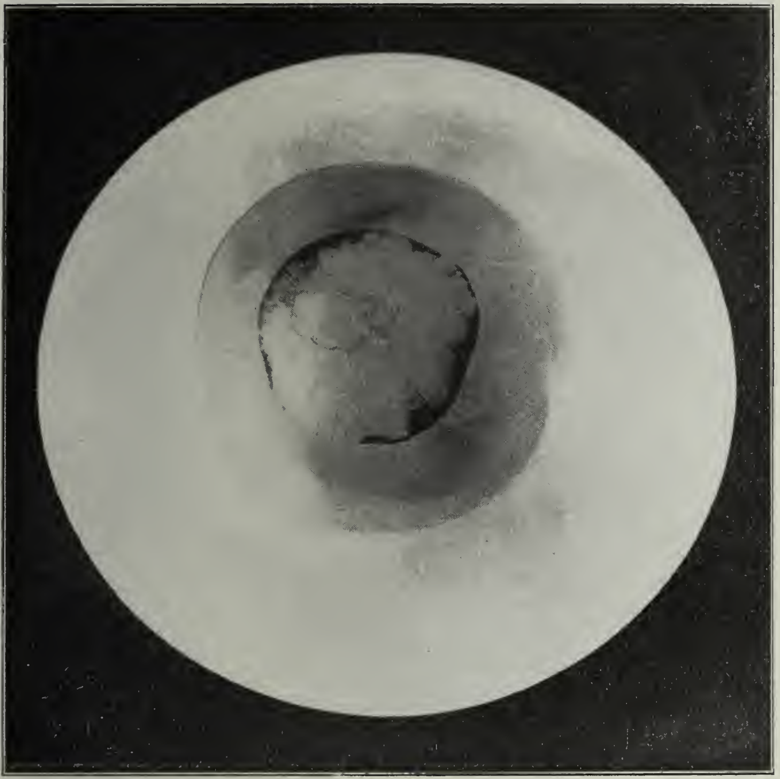

PLATE 2. Fertile egg allowed to die after being in the incubator seventy-two hours. Notice the pronounced blood ring.

for first-class eggs and add to your profits about 3 cents a dozen, or the difference in price between first-class and second-class eggs.

THE CANDLING PROCESS.

For those who may not be familiar with the process of candling, it may be explained that a fresh egg presents a clear, pale yellow appearance when a bright light shines through it. An inferior or bad egg shows dark spots, blotches, blood veins, and frequently an enlarged air space.

Various devices for candling or testing eggs are used, but all have for the essential principle a strong light in a case which is opaque except for an oval aperture slightly smaller

Courtesy of Bureau of Animal Industry.

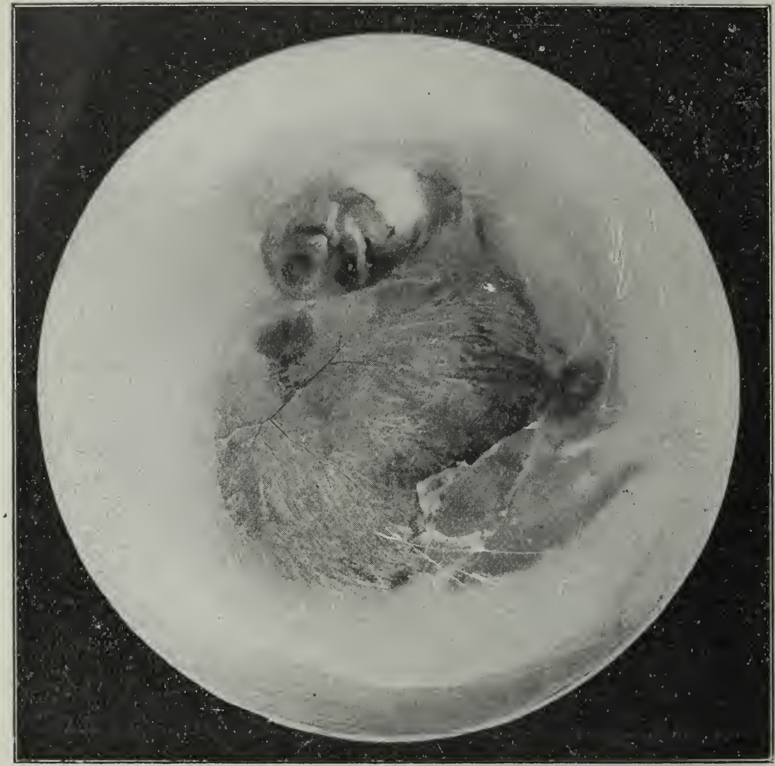

PLATE 3. The fertile egg after seven days of incubation.

than an egg and before which the egg can be quickly placed.

The aperture is made in a diaphragm made of leather or lined with some soft material against which the egg can be firmly pressed so that all the light comes through the egg. The operator works in the dark. A skilful egg candler can quickly tell the approximate age of an egg, whether it is good or bad, the degree of deterioration, and, if it has incubated, to just what extent the germ has developed.

Approved: ______________________

Director Agricultural Experiment Station.

Courtesy of Bureau of Animal Industry.

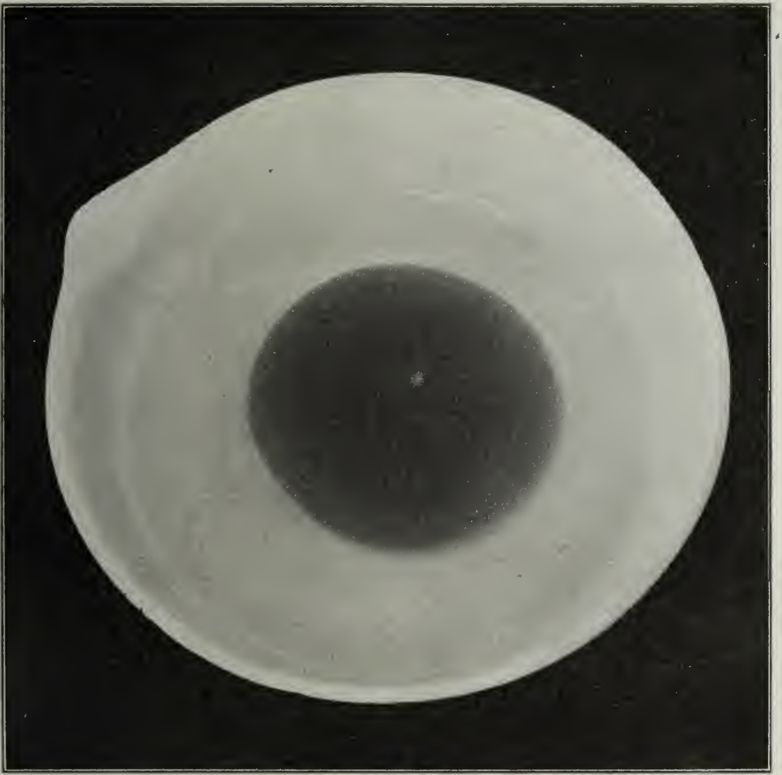

PLATE 4. An infertile egg that has been in the incubator seven days.

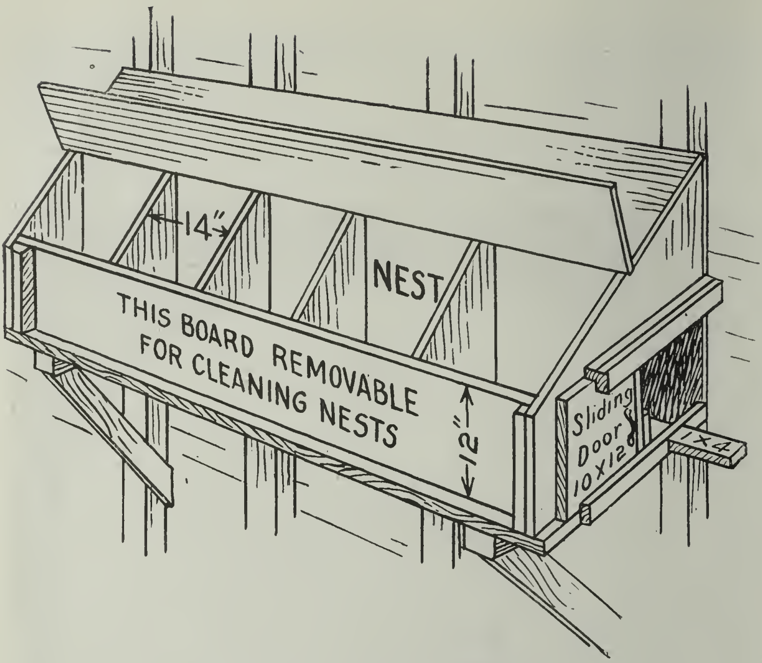

PLATE 5. A good type of wall nest.

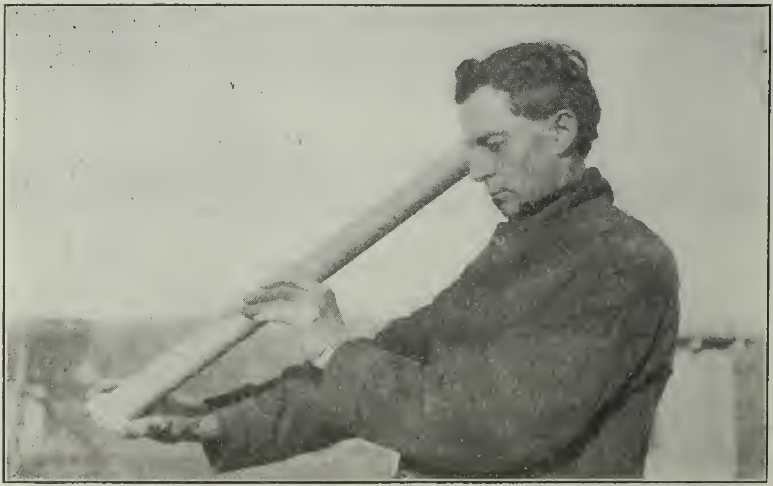

PLATE 6. An easy way to candle eggs—by means of a heavy paper tube and sunlight.

JUNE, 1915. CIRCULAR NO. 52.

AGRICULTURAL EXPERIMENT STATION.

KANSAS STATE AGRICULTURAL COLLEGE.

FEED CONTROL SECTION.

The Kansas Feeding-stuffs Law—Revision of 1913; Amended 1915.

REGULATIONS AND EXPLANATIONS.

FEEDS THAT DO NOT REQUIRE REGISTRATION AND LABEL.

1. Whole seeds or grains.
2. Whole hays, straws, and corn stover, when not mixed with other material.
3. All other material containing 60 per cent or more of water.

FEEDS THAT MUST BE REGISTERED AND LABELED.

1. All feeds except those mentioned above require registration and label. Some of the common feeds requiring registration and label are: Corn chop, kafir chop, oats chop, ground, cut or chopped alfalfa, bran, shorts, wheat mixed feed, corn bran, corn chop and bran mixed, corn-and-cob meal, bran and screenings, wheat mixed feed and screenings, shorts and screenings, cottonseed cake and meal, cold pressed cottonseed, oil meal, meat meal, bone meal, blood meal, tankage, all poultry feeds, all mixed feeds, etc.

INFORMATION REQUIRED UPON THE LABEL.

1. Name and principal address of person or firm responsible for placing the feed upon the market.
2. Minimum *net* weight of the contents of the package.
3. Name, brand or trade-mark of the feed.
4. The guaranty:

Protein, not *less* than....... —— per cent.
Fat, not *less* than.......... —— per cent.
Crude fiber, not *more* than.. —— per cent.

5. The specific name of each ingredient used in manufacturing the feed. (In case any adulterant mentioned in section 12 of the law is added to the feed, the maximum per cent must

be stated upon the label. In this connection attention is called to the fact that unwholesome or injurious materials must not be used in the manufacture of feeds.)

A good form of label is as follows:

100 Lbs. Net Weight.

I. X. L. FEED.

Composed of

Alfalfa, Corn Chop, Kafir Chop, Wheat Bran,
and not over 5 per cent of Corn Bran.

GUARANTY.

Protein, not less than	14.5%
Fat, not less than	3.7%
Crude fiber, not more than	20.3%

Manufactured by
JOHN DOE MILLING COMPANY,
Doeville, Kan.

WHEN REGISTRATIONS EXPIRE.

1. All registrations expire on June 30 of the fiscal year during which they are filed.

TONNAGE TAX.

A tax tag or stamp purchased from the Feed Control Section must be attached to each package, lot or parcel of the following feeds: All poultry foods, or the feeding-stuff by-products of starch factories, glucose factories, cereal breakfast-food factories, breweries and distilleries, meat-packing establishments, or slaughterhouses. *No registration fee* is required on these products. However, each application for registration *must be accompanied* by an order for $5 worth of tags for each brand offered for registration. If it is desired that tags or labels be sent by mail, postage must be included in the order.

REGISTRATION FEE.

1. Flour mills having capacity to manufacture more than 300 barrels of flour in each twenty-four hours are required to pay an annual registration fee of $10 for each brand of feeding-stuff sold in this state.

2. Flour mills having capacity to manufacture more than 50 barrels and not to exceed 300 barrels of flour in each twenty-four hours are required to pay an annual registration fee of $8 for each brand of feeding-stuff sold in this state.

3. Flour mills having capacity to manufacture not to exceed 50 barrels of flour in each twenty-four hours are required to

pay an annual registration fee of $3 for each brand of feeding-stuff sold in this state.

4. In case the same brand is manufactured at more plants than one, a separate registration fee must be paid on said brand for each separate manufacturing plant.

5. The annual registration fee for all other feeds is $8 per brand, except that the fee for chops and corn bran is based upon the following schedule:

(*a*) $1 when the annual output of chops or corn bran does not exceed 50 tons.

(*b*) $2 when the annual output of chops or corn bran is more than 50 tons and does not exceed 200 tons.

(*c*) $5 when the annual output of chops or corn bran is more than 200 tons and does not exceed 500 tons.

6. It is also provided that any firm or person registering any chops or corn bran and paying less than the maximum fee of $8 shall on or before June 30 of each year file with the Director of the Experiment Station a sworn statement of the maximum amount of said chops or corn bran sold within the state during the past fiscal year.

CHANGES IN COMPONENTS OR IN GUARANTY.

Before any changes can be made in the components or in the guaranty of any registered feed, application for permission to make such change must be made to the Feed Control Section. If the reasons given for making the change are deemed satisfactory, permission will be granted.

DEFINITION OF THE TERM "BRAND."

1. "The term 'brand,' as used in this act, is to be taken to mean: First, the name, trade-mark or other designation under which a commercial feeding-stuff is sold; and second, the feeding-stuff itself."

It should be noted that separate registration will be required upon the various brands or grades of shorts.

COMMERCIAL FEED DEFINITIONS AND STANDARDS.

1. *Pure Wheat Bran* shall consist of the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling. *Standard guaranty* which should be equaled: Minimum protein, 14.5 per cent; minimum fat, 3.5 per cent; and maximum crude fiber, 10 per cent.

2. *Wheat Bran and Screenings* shall consist of the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling, plus the various impurities separated from the wheat during the cleaning process, and known collectively as *Screenings*. *Standard guaranty* which should be equaled: Minimum protein, 14.5 per cent; minimum fat, 3.5 per cent; and maximum fiber, 10 per cent.

3. *Standard Wheat Shorts* shall consist of the fine particles of the outer bran, the inner or "bee wing" bran, germ, and the offal or fibrous material obtained in the last reductions on middlings. *Standard guaranty* which should be equaled: Minimum protein, 16 per cent; minimum fat, 3.5 per cent; and maximum fiber, 5.5 per cent.

4. *Wheat Brown Shorts*, as compared with standard shorts, contain mostly the fine particles of bran and germ, and contain much less of fibrous offal obtained from the "tail of the mill." *Standard guaranty* which should be equaled: Minimum protein, 16 per cent; minimum fat, 3.5 per cent; and maximum fiber, 6.5 per cent.

5. *Wheat White Shorts*, as compared with standard shorts, shall contain a smaller portion of the fine bran particles and germ and a much greater portion of the fibrous offal from the "tail of the mill." *Standard guaranty* which should be equaled: Minimum protein, 14.5 per cent; minimum fat, 3 per cent; and maximum fiber, 3.5 per cent.

If to any of the above brands of shorts there should be added, either ground or unground, bolted or unbolted, the various impurities separated from the wheat during the cleaning process, and known collectively as *Screenings*, the same shall be registered, labeled, and sold as Standard Shorts and Screenings, Brown Shorts and Screenings, or White Shorts and Screenings, as the case may be, and each must equal the standard guaranty required for the pure product.

Screenings shall consist of the smaller imperfect grains, weed seeds and other foreign materials having a feeding value, separated in cleaning the grain. (Sand, dirt or other substances without feeding value must be eliminated from screenings before they are added to any feed.)

The word *Screenings* shall appear as part of the label or brand name that is required, and shall be printed in the same size and face of type as the remainder of the label. For example, "WHEAT BRAN AND SCREENINGS," and not "WHEAT BRAN" and screenings.

6. *Pure Wheat Mixed Feed* shall consist of pure wheat bran and standard wheat shorts combined in the proportions obtained in the usual process of commercial milling. Feed sold as Wheat Mixed Feed must consist of bran plus the standard shorts, or the total feed. It does not consist of bran plus brown shorts only. *Standard guaranty* which should be equaled: Minimum protein, 16 per cent; minimum fat, 3.5 per cent; and maximum fiber, 8.5 per cent. The name of each ingredient—for example, pure wheat bran, pure standard wheat shorts—should also be given on the label. (This feed has commonly been known as Mill Run or Mill Run Bran.)

7. *Wheat Mixed Feed and Screenings* shall consist of the wheat bran and standard wheat shorts, to which have been added the various impurities separated from wheat during the cleaning process and known collectively as *Screenings*. The name of each ingredient—wheat bran, standard wheat shorts, and wheat screenings—and the maximum percentage of screenings shall appear on the label. *Standard guaranty* which should be equaled: Minimum protein, 16 per cent; minimum fat, 3.5 per cent; and maximum fiber, 8.5 per cent.

8. *Chop* shall be composed wholly of ground, cut or chopped kernels of grain from which no portion has been abstracted for the manufacture of other substances, and to which no other substance has been added. If it is sold under the name of any one cereal, it must be composed of that cereal only.

9. *Corn Chop* shall be composed wholly of ground, cut or chopped kernels of corn from which no portion has been abstracted for the manufacture of other substances, and to which no other substance has been added. *Standard guaranty* which should be equaled: Minimum protein, 9 per cent; minimum fat, 3.5 per cent; and maximum crude fiber, 3.5 per cent.

10. *Kafir Chop* shall consist of the entire grain removed from the head and chopped.

11. *Corn Bran* shall consist of the outer coating of the corn kernel as produced in the usual process of commercial milling.

12. *Hominy Meal, Hominy Feed, or Hominy Chop* is a mixture of the bran coating, the germ, and a part of the starchy portion of the corn kernel obtained in the manufacture of hominy grits for human consumption.

13. *Alfalfa Meal* is the entire alfalfa hay, ground, and shall not contain an admixture of ground alfalfa straw or other foreign materials.

14. *Linseed Meal* is the ground product obtained after extraction of part of the oil from ground flaxseed screened and cleaned of weed seeds and other foreign materials by the most improved commercial processes.

15. *Blood Meal* is ground dried blood.

16. *Meat Scrap and Meat Meal* are the ground residues from animal tissue exclusive of hoof and horn. If they contain any considerable amount of bone they must be designated *Meat and Bone Scrap,* or *Meat and Bone Meal.* If they bear a name descriptive of their kind, composition or origin, they must correspond thereto.

17. *Digester Tankage* is the residue from animal tissue exclusive of hoof and horn, specially prepared for feeding purposes by tanking under live steam, drying under high heat, and suitable grinding. If it contains any considerable amount of bone it must be designated *Digester Meat and Bone Tankage.*

CAUTION.

Careful observation of the following points will enable you to avoid more or less difficulty in registering your feeds and otherwise complying with the law:

1. *Be sure to fill in carefully and properly all spaces on the application blank.*
2. Do not register under firm name and then use some other name on the label.
3. In filling in name of brand, use the exact name which you expect to place upon your label. For example, do not register wheat shorts and then expect to sell "brown shorts," "white shorts" or "white middlings" under this registration.
4. Give the name of each ingredient used in making up the feed.
5. When the term "bran" is used without any qualifying word it will be assumed that it refers to *wheat* bran only.
6. In making up samples for analysis, small samples should be taken from a number of different sacks, or taken from the spout at different times during the run. These samples should be thoroughly mixed and an average sample consisting of at least two pounds be forwarded for analysis.
7. In making up the guaranty from results of analysis the

percentages of protein and fat should be slightly lowered and the percentage of crude fiber should be raised somewhat to provide for differences in composition of the raw material or slight variations in the manufacturing process, but in no case should the guaranty of a feed for which a standard has been adopted show a less per cent of protein or fat or a greater per cent of crude fiber than the standard. (See table of feed standards.)

8. Manufacturers having difficulty in determining proper guaranties are invited to write to the Feed Control Section regarding this difficulty.

9. *Keep a record in your office of all feeds registered, together with their components and guaranties.*

10. Be sure that all feeds leaving your plant are properly registered and labeled.

11. Dealers should see that all feeds are properly labeled before exposing them for sale. When tags are torn off in handling, duplicate tags must be attached.

12. The specific name of each ingredient must be stated on the label. In case the feed is adulterated with any foreign mineral matter or other foreign substance, such as rice hulls, chaff, corn-cob meal, corn bran, oat hulls, oat clippings, or other materials of less or of little or no feeding value, the kind and maximum amount of such adulterant must be stated upon the label.

13. All whole meals or chops must be registered and labeled.

APPLICATION BLANKS.

1. All applications for registration must be made on blanks furnished by the Feed Control Section. Each application must be accompanied by the necessary registration fee, made payable to the Feed Control Section, or, in case of feeds on tonnage tax basis, by an order for not less than five dollars' worth of stamps or tags for each brand of feed registered.

AFFIDAVIT BLANKS.

1. Blank forms for making affidavit as required by law governing registration of chop and corn bran will be furnished by the Feed Control Section upon request.

REGISTRATION SAMPLES.

1. When called for, samples of all feeds must be sent prepaid with the application for registration. A registration sample should consist of at least one pound.

COPY OF LABEL.

1. In order to avoid misunderstandings it is requested that a sample tag, or copy of the label required by section 2 of the law, be submitted with each application for registration.

ANALYSIS OF SAMPLES.

1. If the manufacturer or seller desires the Experiment Station to make chemical analysis of sample to determine fat, protein and fiber required in the guaranty, this work will be done at the following rates: Charge for determining fat, $2; protein, $2; crude fiber, $4; or all three for $5. The Experiment Station does not guarantee that the analysis made of samples submitted by a manufacturer or seller is representative of the product sold by each manufacturer or seller. The Station merely guarantees that the composition of the sample submitted is as reported. Manufacturers and sellers taking samples for analysis should be extremely careful to secure a representative sample. Their attention is called to Caution 6 for directions in taking such samples.

Feed Standards.

	Protein. Not less than—	Fat. Not less than—	Crude Fiber. Not more than—
Pure wheat bran	14.5%	3.5%	10.0%
Wheat bran and screenings	14.5%	3.5%	10.0%
Wheat bran and scourings	14.5%	3.5%	10.0%
Standard wheat shorts	16.0%	3.5%	5.5%
Standard wheat shorts and screenings	16.0%	3.5%	5.5%
Wheat brown shorts	16.0%	3.5%	6.5%
Wheat white shorts	14.5%	3.0%	3.5%
Wheat white shorts and screenings	14.5%	3.0%	3.5%
Pure wheat mixed feed	16.0%	3.5%	8.5%
Wheat mixed feed and screenings	16.0%	3.5%	8.5%
Wheat mixed feed and scourings	16.0%	3.5%	8.5%
Corn chop	9.0%	3.5%	3.5%

CORRESPONDENCE.

1. All correspondence relating to the registration of feedingstuffs should be addressed to the Feed Control Section, Experiment Station, Manhattan, Kan.

PURPOSE OF THE LAW.

1. The whole intent and purpose of the feeding-stuffs law is to compel each feed to be sold for exactly what it is, and upon its own merits. A consumer is entitled to know what he is buying and paying for. A manufacturer or dealer is entitled to know what is being sold. The fact that a feed is registered is evidence that it contains nothing harmful, if properly used. The declaration of the manufacturer must be true to fact if the feed is registered. The inspection and analysis at frequent intervals informs the director of the Experiment Station of the reliability of the manufacturer's or seller's guaranty. If the feed does not come up to the guaranty the license will be revoked. The law is a protection to the consumer, dealer, and manufacturer.

Table of Analyses of Mill Products at Kansas State Agricultural College, 1914-'15.—May 1, 1915.

COMMODITY.	Protein.			Fat.			Crude Fiber.			No. Samples.
	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	
Wheat bran	20.71	14.95	17.36	5.54	3.86	4.52	13.01	8.58	10.26	50
Wheat bran and screenings	20.01	15.05	17.68	5.55	3.76	4.52	13.62	8.97	10.76	101
Wheat bran and scourings	19.71	14.52	17.12	4.50	3.92	4.26	14.14	8.38	10.53	10
Corn bran	12.64	7.64	10.86	8.59	4.09	7.42	13.15	6.13	8.58	10
Standard shorts	22.50	14.85	19.25	5.80	2.18	4.57	8.75	2.11	5.57	101
Shorts and screenings	21.85	16.10	19.18	5.79	3.55	4.80	9.39	3.71	5.82	48
Shorts and scourings	19.66	17.15	18.41	5.40	3.40	4.40	7.08	3.20	5.14	2
Brown shorts	22.64	16.36	17.64	6.13	3.82	4.73	7.70	4.68	6.71	17
Brown shorts and screenings	20.45	20.22	20.34	5.62	5.44	5.54	9.71	7.15	8.21	3
White shorts	20.09	13.69	17.64	5.05	1.37	3.47	5.96	1.20	3.45	26
White shorts and screenings	19.91	15.05	18.63	4.90	2.48	3.96	6.49	1.86	4.49	17
Wheat mixed feed	19.70	16.94	17.89	5.25	4.31	4.73	10.68	8.24	9.08	10
Wheat mixed feed and screenings	19.40	16.24	18.15	5.22	3.48	4.63	12.61	6.74	9.05	29
Corn chop	12.72	8.62	10.38	6.06	2.76	3.93	3.80	1.65	2.29	192
Corn chop and corn bran	11.14	8.95	10.03	4.56	3.08	3.77	3.73	1.78	2.47	14
Kafir chop	15.09	11.50	13.16	4.41	2.94	3.59	3.65	1.63	2.67	18
Milo chop	12.02	10.31	11.25	3.43	3.22	3.32	2.27	1.92	2.08	3
Barley chop	15.09	13.08	13.84	2.35	1.70	2.05	8.18	5.43	7.23	5
Alfalfa meal	19.31	13.03	14.42	3.03	1.56	2.21	33.61	26.24	28.62	13
Hominy feed	13.16	11.00	13.82	9.73	7.38	8.77	7.72	4.12	5.83	5
Linseed meal	39.40	34.66	36.96	8.80	1.92	6.53	9.67	7.14	8.25	9
Cottonseed meal	48.11	38.05	45.09	11.09	6.60	8.12	16.53	7.20	14.45	26
Cottonseed cake	51.50	42.22	43.27	13.54	6.03	7.62	13.25	6.38	9.76	24
Cold pressed cottonseed	28.75	23.03	24.54	12.57	6.62	8.49	28.91	24.58	23.71	10

Approved:

W. M. JARDINE,
Director Agricultural Experiment Station.

JULY, 1915. CIRCULAR NO. 53.

AGRICULTURAL EXPERIMENT STATION.

KANSAS STATE AGRICULTURAL COLLEGE.

DAIRY DEPARTMENT.

Filling Silos.

J. B. FITCH.

THE rapidity with which silos have been adopted on Kansas farms in the last few years has made it necessary for many farmers to fill their silos and care for the silage without previous experience. Through the advice of other silo users they have had more or less success in securing good silage. As their knowledge of making silage increases with years of silo experience the quality of silage will generally be improved, as will also the efficiency of the filling operation.

It is the object of this paper to answer some of the most common questions which arise at silo-filling time. Such methods will be treated as have been found by experimental evidence and by practical use to be most successful in producing good silage.

TIME TO CUT THE SILAGE CROP.

It is desirable to cut the crop for the silo at a time when it contains the maximum food nutrients in a condition that will make good silage. Years ago corn was cut for the silo in a very green condition, before the ear and stalks had matured, and a very sour silage, high in moisture, was obtained. Of late years the tendency has been to allow the corn crop to stand until more mature. The proper time to cut corn for the silo is about a week or ten days before it is ready to put up in the shock; the ear should be well dented and the lower leaves on the stock dry, but the stalk itself still full of sap. Corn in this condition contains the maximum food nutrients and at the same time sufficient moisture to cause it to pack well in the silo. It is advisable to let the corn approach maturity before cutting it, even if water will have to be added at filling time, as is often the case when a few days of hot winds dry the leaves and stalks very rapidly. In the case of short, immature corn the practice is to let the corn stand in the field just as long as it will continue to grow. This corn is generally very dry, and water must be added when the crop is put into the silo. Corn should not be allowed to get so dry that the leaves shatter badly.

As in the case of corn, the sorghums were formerly cut in a green condition and a very acid silage resulted, due to a greater amount of sugar in the sorghums. The sorghums should be cut for the silo when the heads are mature and when the seeds are so hard that they can not be crushed between the thumb and finger. Late-planted sorghums often reach the frost date before maturing. Light frosts do not materially affect the sorghums, which should be allowed to stand until frosted rather than put in the silo in an immature condition.

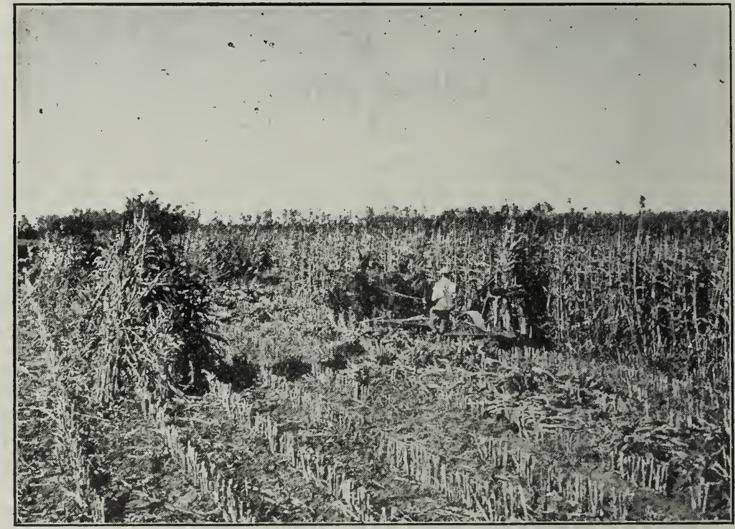

FIGURE 1. Cutting early Amber cane for the silo.

CUTTING THE CROP.

The most convenient method of cutting silage crops is by means of a corn binder. When large silage cutters are used, with a short haul from the field, the binders should be started a day before filling is to begin. With smaller outfits a half day's start with the binder is sufficient to keep the silage cutter busy.

In some cases underslung racks are made especially for hauling silage corn. Those wagons lessen the burden of loading in the field, but in throwing to the silage cutter the ordinary rack is most convenient. For the difference in labor of the two a person is not justified in making a rack of this nature to be used only during silage-filling time.

SIZE OF CUTTER.

The desirable size of silage cutter depends upon the number of silos one has to fill and upon the men and teams available. A large cutter run to its fullest capacity reduces to the minimum the cost per ton of silage. Cutters varying in size from eighteen to twenty-two inches will keep five or six teams busy hauling from a short distance. Additional teams will be needed for hauling from a greater distance. For smaller cutters the number of teams depends upon the size of the cutter and the power furnished. When four to six teams are used, two or three men will be needed in the field to assist the drivers in loading. With large cutters and a large force of help, eighty to one hundred tons of silage can be put up in a day. Where labor is scarce, smaller outfits are used over a longer period of time. This gives the silage more time to settle during the filling process, and it can also be packed better than where the large outfits are used. With the larger cutters time is saved in feeding the machine because the bundles need not be cut, while with the smaller machines cutting the bundles is necessary to prevent the cutter from choking. One man is needed at the cutter to feed and operate it properly. With a large cutter one man in addition to the teamster is need on the load to pitch to the cutter. In the case of a small machine each teamster can throw off his own load.

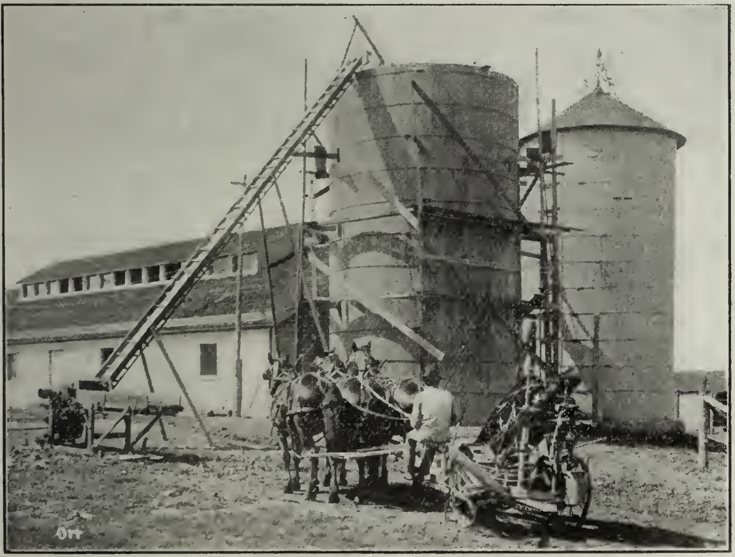

FIGURE 2. Silage cutter, with open carrier for elevating the cut material into the silo.

POWER REQUIRED.

Sufficient power should be furnished to run the cutter to its capacity. The power required is generally specified in horsepower for gas and steam engines, and should be followed carefully. The power necessary depends upon the size of the cutter used and the method of elevating the cut material into the silo. The common method is that of blowing the cut material up a pipe and into the silo by means of a powerful fan.

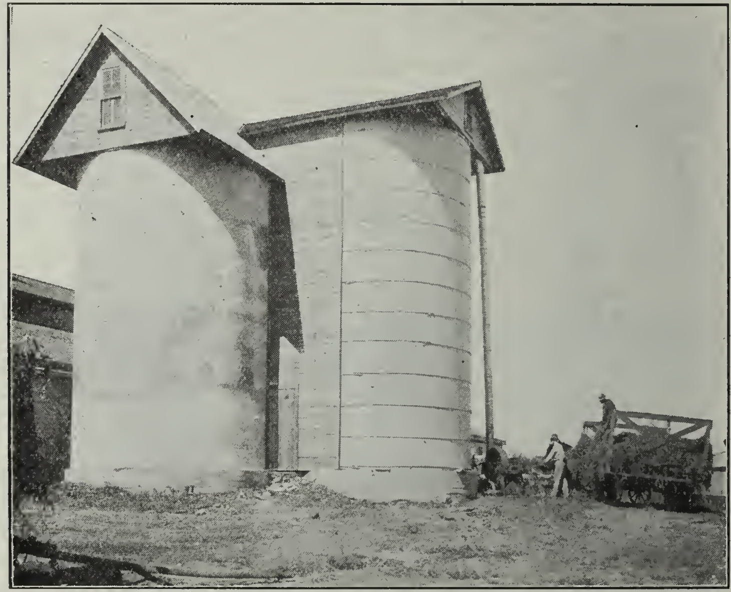

FIGURE 3. Filling silo with oats and peas.
Notice the cutter with blower for elevating the cut material.

In many cases a continuous chain carrier is used to elevate the cut material into the silo. The use of the carrier lessens the power required to about half of that necessary when the blower is used. This means that on such an outfit for filling silos money can be saved because a lower-power engine can be used. The open carriers have been objected to on account of the lighter materials, such as leaves and husks blowing out. This difficulty can be overcome by use of covered carriers. The carriers are probably more cumbersome to transport than the blower. Where power is available, the blower is to be preferred.

CUTTING SILAGE.

For the most efficient packing, the knives on the cutter should be sharp and should be set to cut the material into pieces one-half to three-fourths of an inch in length. When the cut material goes into the silo some provision is necessary so that the heavy and lighter particles will be evenly mixed throughout the silage. If allowed to fall into the silo, naturally the heavy particles settle in one pile and the leaves and other light particles blow to the outside. The common method is to use a distributor, which consists of a series of galvanized iron pipes three to four feet long which fit into each other and can be taken off as the silo is filled. This distributor connects with the blower pipe at the top of the silo and carries the cut material in a compact mass to the bottom of the silo. The distributor eliminates much of the objectionable work on the inside of the silo and saves the work of one man. A good distributor can be made by sewing together sacks with the bottoms removed, through which the silage can pass from the top of the silo In the absence of some sort of distributor, a chute should be made by which the cut material, before falling, will be delivered to the center of the silo. A man with a fork can distribute the material evenly about the surface of the silage.

ADDING WATER.

To make silage it is necessary that the air be excluded. To exclude the air the cut material must be of sufficient weight to pack well. When the crop is dry it comes into the silo in a very fluffy condition, and, as it can not be packed tight enough to exclude all the air, air pockets are formed which cause mouldy spots in the silage. When the material is too dry, water should be added to it as it goes into the silo. When corn is cut at the proper time it is near the danger line of moisture. It takes experience to tell whether or not water must be added, but perhaps the best guide is to notice how the material comes into the silo. It should be moist enough to pack firmly under one's foot when tramped, and water should be added to the dry, fluffy material until this condition is reached. While silage that is too wet is not desirable, it is hard to injure silage from adding water to it. Excessive dryness, on the other hand, causes spoiled silage. In case of doubt, therefore, water should be added. The common practice and most desirable method of adding water to silage material is to run a stream of water into the blower. In this way each particle comes into contact with the water and the moisture is evenly distributed throughout the silo. Where it is impossible to add water to the blower, the water can be added in the silo. It should be well distributed in the silo, because a great amount of water added in one place is apt to run down through the silage and leave dry places at the surface. It is impossible to state the amount of water to add to silage. The material itself is the determining factor. Silage near the top of the silo should receive more water than that lower down. This will make greater weight for the silage near the top of the silo, where it does not have much weight on it.

PACKING SILAGE.

Perhaps the most important operation in filling a silo is getting the silage properly packed. More silage is spoiled by improper packing than by any other cause controlled by the farmer. When the silage is not tramped sufficiently to exclude the air, spoiled silage results. It is known, too, that the more the silage is tramped in the filling process the less it settles afterwards. When the silage settles in the silo it tends to draw away from the wall, thus leaving an air space which results in spoiled silage. The amount of tramping necessary depends upon the rate of filling. When a small outfit is used over several days, the slow filling gives more time for the silage to be tramped, and the silage settles from day to day. With a large outfit, however, the silage should be well tramped, as it goes in more rapidly, and if not well tramped will settle several feet after the silo is filled. The capacity of the silo, unless refilled, will thus be reduced and a large amount of spoiled silage may also result. With a small cutter, two men in the silo are perhaps sufficient, one to carry the distributor and the other to do the tramping. With larger outfits, two or three men in addition to the man carrying the distributor are needed. If convenient, the men may be changed from the silo to the field and the monotony of the work be relieved. In case of any short delay in filling, the entire force can be used in tramping the silage.

An important factor in packing silage is the manner of distributing it in the silo. The most common method is to build the silage about two feet high around the walls and tramp this well; then fill up the center and tramp it equally; and then again build up around the walls. By this means the silage will settle without pulling away from the wall. At the top the silage can be rounded off by being made higher in the center, and within a few days will settle till nearly level. Tramping is more important in the upper half and top of the silo, because this silage will have less weight on it to force it down.

GAS IN SILOS.

It is well to remember that during the process of fermentation that goes on in the silo a gas is given off for the first few days after filling. This gas may prove dangerous to those who breathe it. It is heavier than air and covers the surface of the silage to a depth of a foot or more after the silage has stood over night, or when the blower is not running and where no drafts of air enter the silo. This gas is most frequently found in pit silos. Silo doors should not be put up until needed, and in pit silos and silos inclosed in barns it is a desirable precaution to run the blower or cutter a few minutes before the men enter the silo, in order that a circulation may be started and the gas mixed with air. In case of doubt as to the presence of gas, a lighted lantern may be lowered to the surface of the silage. If the light goes out the gas is present and a circulation should be created in the silo before a person enters. Within a week after the silo is filled this gas will generally have disappeared and no trouble will be experienced in the feeding of the silage.

REFILLING THE SILO.

Silage will gradually settle in the silo for a few days after it is filled. The amount of settling depends upon the rapidity of filling the silo and the amount of tramping. It is desirable, where the silage settles much, to arrange for refilling in order to increase the capacity of the silo. This refilling may be done two or three days after the first filling. The top few inches of spoiled silage may be thrown off, the additional silage added, and the top sealed. Many farmers who do not have a roof on their silo are increasing the capacity by placing wire fencing on posts at the top of the silo and then filling this additional height. When the silage settles it will generally make the silo about full and the wire may be taken down. Good results have also been reported from the use of folding iron silo roofs, which can be opened to give additional height to the silo and closed down when the silage settles.

SEALING THE SILO.

It will be noticed, following a day's filling, that the surface of the silage has become very hot. This heat is mostly in the surface foot in contact with the air. If filling is continued the action will be stopped, but if a day or so intervenes before filling is started again this surface will probably be spoiled and should be thrown off. When this surface is allowed to stand for some time it will spoil to a depth of from six to eight inches. Underneath this rotted layer the silage will be good. This covering acts as a natural seal for the silage. The depth to which silage will spoil on top depends upon the amount of tramping it has received and upon the moisture in the silage. When the silo is full, as much as twenty barrels of water should be added and the silage then thoroughly tramped. For a day or so following this it is a good plan to tramp the silage each day, especially around the wall of the silo. After this the silage will not settle much, and it is best not to break through the seal by walking on it. When this method is employed, six to eight inches of spoiled silage will probably be lost. In many cases, however, the silage spoils to a greater depth because of rapid settling and poor tramping.

Many plans are used for reducing this spoiled silage to a minimum. As the spoiled material will probably not represent a loss of more than one or two tons of silage, a farmer can not afford to spend much time and money to reduce it. The loss may be lessened by husking out the last few loads of corn or heading the last loads of sorghum that go into the silo. Straw may be run through the cutter and spread over the surface of the silage, and when thoroughly wet and well tramped will make a good seal. After the top of the silage has been thoroughly wet down and well tramped, a layer of oats on this will sprout rapidly because of the heat underneath, and will form a layer over the surface of the silage. A thin layer of salt sprinkled over the top of the silage after it is wet down and well tramped will cut down the amount of spoiled silage. Another method used is to cover the top of the silage with tar paper.

WHEN TO FEED SILAGE.

Silage may be fed as soon as the silo is filled, but for the first few days will be nothing more than cut corn. In a short time, however, the change to silage will have been completed and a uniform feed will be found throughout the silo. If one begins to use the material from the silo immediately after it is filled, no seal is necessary, and silage is saved. After opening a silo it is necessary to feed about two inches from the surface daily to keep the silage from spoiling.

Any spoiled silage which occurs in the silo should be discarded. Cattle will sometimes eat spoiled material, but bad results often occur from this source. In feeding horses one must be extremely cautious in this regard, as horses are much more susceptible to disorder from spoiled silage than are cattle.

MIXING CROPS IN THE SILO.

Many farmers who are raising both corn and sorghum mix these crops in the silo. In some cases loads of the different crops are run through the machine alternately, or it is arranged that a load of each feed shall be at the cutter at the same time. This mixing does not increase the value of either feed, and generally means more work, in that material must be hauled from two fields at the same time. As a matter of fact, the sorghums are generally not mature enough to go into the silo until some time after the corn crop has been cut.

SEPTEMBER, 1915. CIRCULAR NO. 54.*

AGRICULTURAL EXPERIMENT STATION.

KANSAS STATE AGRICULTURAL COLLEGE.

ZOOLOGY DEPARTMENT.

The Prairie-dog Situation.

R. K. NABOURS.

METHODS OF COMBATING PRAIRIE-DOGS.

After a few months of experimentation, in 1901, Mr. D. E. Lantz, then of this Station, adopted poisoning as the cheapest and most easily applied method of ridding our western lands of prairie-dogs. The right to use a certain formula, protected by letters patent, was purchased for the state. This formula has since been followed pretty closely in the preparation of the poison mixture. That it does the work as efficiently and thoroughly as any substance or means which has been discovered or devised is attested by the almost universally favorable reports on its use and by the disappearance of the hordes of prairie-dogs from the farms and cattle ranges of the West.

The poison mixture is in the form of a syrup, prepared as follows:

Ingredients for One Quart of Syrup.

1 oz. strychnia sulfate (powered).
1 oz. potassium cyanide.
1½ oz. alcohol.
1 pt. syrup.

PREPARATION.

One ounce of green coffee berries is mixed with the white of one egg and allowed to stand fourteen hours or more. The strychnia is dissolved in a half pint of boiling water. The potasium cyanide is dissolved in a quarter pint of hot water and allowed to cool.

A little warm water is then added to the mixture of coffee and eggs and mixed with the potassium cyanide. Strain this mixture through a coarse sieve into the mixing vessel and add the syrup. Mix the alcohol with the hot solution of strychnine and add it to the other mixture. Stir all thoroughly.

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* Abridgment of Station Circular No. 4, by T. H. Scheffer.

This mixture is put up in cans of two sizes, quart and half-gallon. It is intended to be used with wheat or kafir as bait.

HOW TO OBTAIN THE POISON.

The Station has undertaken the preparation and sale of prairie-dog poison. This is done without profit, in pursuance of the policy of the institution to extend its usefulness along as many lines as possible. The price, which covers the cost of materials and preparation, is $1.75 per half-gallon can, or 90 cents per quart can. Orders may be sent direct to the Zoölogy Department, Kansas Agricultural Experiment Station, Manhattan, Kan., but all remittances, except in currency, should be made payable to the financial secretary of the College. Poison will not be sent to persons unknown to us unless the order is accompanied by remittance. We make an exception to this rule in the case of orders sent in by the proper officers, such as county agents or township trustees.

HOW THE POISON IS SHIPPED.

Single cans of poison are securely wrapped and sent by express unless otherwise ordered. Two cans may be wrapped together and sent in the same way, but larger orders are boxed. Shipment of poison by mail is contrary to postal regulations. The purchaser should always state whether he wishes the poison sent by express or freight. In ordering poison, both your post-office address and nearest shipping point should be given. Advice by mail is given the day that shipment is made. If there is delay in receiving the shipment, or if any of the cans are damaged and leaking, the Zoölogy Department should be notified at once.

MIXING AND PUTTING OUT THE BAIT.

Failure to get good results has been traced in every case to carelessness or neglect of specific and simple directions in using the poison. The following directions for use are printed on the label of every can:

Directions for Use.

"For every quart of syrup take a half bushel of clean wheat or kafir in a large metal tub. After thoroughly shaking and stirring the contents of the can, pour it over the grain and stir until every part is thoroughly wet with the poison. Then stir in two or three pounds of fine corn meal to take up the extra moisture. Let the mixture stand in a shed over night, and put it out early the next morning if the weather is fine. Place half a tablespoonful or less of the bait in two or three little bunches at the outside of each burrow occupied by prairie-dogs. Only occupied burrows should be poisoned. A half bushel of grain should poison from 500 to 600 holes."

STIRRING THE SYRUP. Special pains should be taken to see that the contents of the can are thoroughly mixed before being poured over the grain. The two poisons, strychnia and potassium cyanide, are insoluble in the presence of each other, and settle to the bottom of the can like the lead in mixed paints. When used in cool weather, as is usually the case, the cans should be set in hot water for a short time and then shaken thoroughly while in an inverted position. It may even be necessary in some cases to stir the contents of the can with a stick.

WHEN TO POISON. While some degree of success may be attained by putting out our prairie-dog poison at any season of the year, we do not advise its use except in winter and early spring. When fresh grass or other vegetation is to be had the prairie-dogs do not take the poison bait readily. Any bright sunshiny day in January, February or March is favorable, provided it warms up enough to bring the "dogs" out for an airing. The very best time is a period of thaw following stormy weather, especially when the latter was accompanied by snow. When the thaw succeeds the storm the prairie-dogs wake up and crawl out "hungry as bears" and ready to eat anything in sight. The person who has the poisoning in charge must use his judgment as to favorable days for work. It is of no use to put out poison when the "dogs" will not come out. Much money has been wasted in certain townships by keeping a gang of men steadily at work poisoning for two or three weeks at a time, when some of the days were rainy or stormy. Under such conditions the potassium cyanide rapidly deteriorates, and, if rainy, the strychnia is also dissolved out and lost. Then, too, for the sake of our valuable birds, the poison ought not to be put out except at times when it is likely to be quickly taken by the animals for which it is intended.

TOWNSHIP METHODS.

DUTIES OF THE TRUSTEE. In all townships infested by prairie-dogs the trustee is required by law to purchase poison and to have the oversight of putting it out, or to use such other materials and appliances as he may deem necessary to destroy the "dogs." He is allowed $2 per day for this supervision, and may hire as many helpers as he needs, paying them $1.50 per day. In the exercise of this latter function the trustee ought to use the same judgment and care that he would in hiring men to work for himself. Taxpayers have stated that young boys or irresponsible men were sent out to do work that required the maximum of care and judgment. The poison bait is often disposed of in a way to get rid of it instead of being deposited carefully in little piles about the entrance to the prairie-dog burrows. It is often left in situations where the lives of valuable birds and domestic animals are endangered.

Giving out the Poison. In some townships the trustee adopts the plan of distributing the cans of poison among the residents of his township and letting them put it out on their own lands without compensation. This plan is hardly within the contemplation of the law, but it has some advantages, as well as disadvantages. It enables the scattered settlers in large townships to clear the prairie-dogs off their own lands and adjoining borders of the lands of nonresidents. Some of these western townships are very large—twelve miles square, or even twelve by twenty-four miles in size—and trustees protest that the expense of hiring men to put out poison over such an extensive tract would more than bankrupt their treasury. Another advantage of the plan lies in the fact that men will ordinarily exercise more care in putting out the poison on their own lands than might be expected of persons hired by the trustee. Objections to the plan are, first, that the lands of nonresidents are left as breeding grounds for the prairie-dogs. Sometimes these lands constitute the bulk of the territory in a township or county. Again, by giving out a half-gallon can of poison to each landowner who requests it, much of the poison is wasted or allowed to stand around for years to deteriorate. Often the few "dogs" on an individual farm could be destroyed by the use of a pint or less of the poison.

Giving out the Bait. If the plan of giving out the poison to residents of the township is followed it is well to order some cans of the smaller (quart) size. A few trustees have said, however, that they can get more and better results for the township's money by carefully mixing the poisoned bait themselves and giving it out ready for use to those who need it.

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JANUARY, 1916. CIRCULAR NO. 55.

AGRICULTURAL EXPERIMENT STATION.

KANSAS STATE AGRICULTURAL COLLEGE.

DEPARTMENT OF FORESTRY.

Trees for Kansas.

CHAS. A. SCOTT.

There are two classes of trees: conifers and broadleaved.

CONIFERS.

The conifers are the cone-bearing trees. Most of them retain their leaves throughout the entire year, hence as a group they are commonly known as "evergreens." Evergreens include some of the hardiest drouth-resistant trees known. Several of them are well adapted to Kansas soil and climate, being most valuable for protective and ornamental planting. They make a height growth of from twelve to thirty inches per year, which compares favorably with the rate of growth of the broadleaved species. They are long-lived, comparatively free from insect attack, and suffer less injury from hail and windstorms than do the broadleaved species.

Because the evergreen trees retain their leaves, they afford greater protection from the wind during the winter than do the broadleaved deciduous trees. A few rows or a clump properly located makes the best windbreak that it is possible to grow. They will grow in the poorest rocky or sandy soils in the state, as well as in the driest clay soils. They should not be planted in gumbo, alkali, or poorly drained soils. Most of the evergreen trees are highly ornamental and merit greater consideration for yard planting than they have received in this state.

In planting evergreen trees only transplanted stock should be used. When several hundred are to be planted for hedges, windbreaks, or woodlots, transplanted stock twelve to eighteen inches in height gives the best results. Trees of this size cost less, are more cheaply planted, and sustain no greater loss than the larger sizes. When only a few are to be set, larger-sized stock is more desirable, since they have ornamental value from the time they are planted. Trees from three to five feet in height may be used. However, this size can be handled safely only when balled and burlapped; *i. e.,* with balls of earth bound securely about the roots.

BROADLEAVED TREES.

The broadleaved trees are known commercially as "hardwoods" and include all trees not included in the evergreen group. Native trees, such as the elm, ash, oak, cottonwood, basswood, and maple, are included in this group. Some of these trees retain their leaves throughout the greater part of the year; as for example, the holly, magnolia, live oak, and the trees of the tropics. They are seldom referred to as evergreens, however, and are never grouped as such botanically. The hardiness of the broadleaved trees varies with each species. Many of them are well adapted to eastern Kansas conditions and the hardiest of them grow successfully in western Kansas.

Because of the great difference in climate between the eastern and the western part of Kansas, it is necessary to choose trees suited to the section in which they are to be grown. The following lists indicate the species adapted for the different sections of the state.

TREES AND NATIVE SHRUBS FOR THE SECTION IN WHICH THE AVERAGE RAINFALL EXCEEDS THIRTY-FIVE INCHES.

Evergreens suitable for protective and ornamental planting:

White pine (*Pinus strobus*).
Red or Norway pine (*Pinus resinosa*).
Table Mountain pine (*Pinus pungens*).
Pitch pine (*Pinus rigida*).
Austrian pine (*Pinus austrica*).
Scotch pine (*Pinus sylvestris*).
Swiss Mountain Pine (*Pinus mugho*).
Colorado blue spruce (*Picea parryana*).
White spruce (*Picea canadensis*).
Black Hills spruce (*Picea englemanni*).
Norway spruce (*Picea excelsa*).
Douglas fir (*Pseudotsuga mucronata*).
White or silver fir (*Abies concolor*).
Chinese arbor vitæ (*Thuja orientalis*).
Bald cypress (*Taxodium dictichum*).
Dwarf juniper (*Juniperus communis*).
Red cedar (*Juniperus virginiana*).

Broadleaved species suitable for street and yard planting:

Sugar maple (*Acer saccharum*).
Silver maple (*Acer saccharinum*).
White oak (*Quercus alba*).
Red oak (*Quercus rubra*).
Pin oak (*Quercus palustris*).
Burr oak (*Quercus macrocarpa*).
Hackberry (*Celtis occidentalis*).
White elm (*Ulmus americana*).
Rock or Cork elm (*Ulmus thomasi*).
English elm (*Ulmus campertris*).
Tulip tree (*Liriodendron tulipifera*).
Sycamore or plane tree (*Platinus occidentalis*).
Black cherry (*Prunus serotina*).
Red bud (*Cercis canadensis*).
Kentucky coffee tree (*Gymnocladus dioicus*).
Thornless honey locust (*Gleditsia triancanthos*).
White ash (*Fraxinus americana*).
Green ash (*Fraxinus lanceolata*).
Russian wild olive (*Elæagnus angustifolia*).
Pecan (*Hicoria pecan*).
River birch (*Betula nigra*).
Basswood (*Tilia americana*).
Carolina poplar (*Populus deltoides var. caroliniana*).
Tree of heaven (*Ailanthus glandulosa*).
Red haw (*Cratægus mollis*).
Cockspur (*Cratægus crus-galli*).
Wild crab (*Malus cornaria*).
Service berry (*Amelanchier canadensis*).
Sumach (*Rhus copallina*).
Smooth sumach (*Rhus glabra*).

Trees suitable for wood-lot planting:

Austrian pine (*Pinus austrica*).
Red cedar (*Juniperus virginiana*).
Cottonwood (*Populus deltoides*).
Black walnut (*Juglans nigra*).
Hardy catalpa (*Catalpa speciosa*).
Burr oak (*Quercus macrocarpa*).
Red oak (*Quercus rubra*).
Pecan (*Hicoria pecan*).
White ash (*Fraxinus americana*).
Osage orange (*Toxylon pomiferum*).

TREES AND SHRUBS FOR THE SECTION IN WHICH THE ANNUAL RAINFALL IS BETWEEN TWENTY-FIVE AND THIRTY-FIVE INCHES.

Evergreens suitable for protective and ornamental planting:

Western yellow pine (*Pinus ponderosa*).
Table Mountain pine (*Pinus pungens*).
Austrian pine (*Pinus austrica*).
Scotch pine (*Pinus sylvestris*).
Swiss Mountain pine (*Pinus mugho*).
Colorado blue spruce (*Picea parryana*).
Black Hills spruce (*Picea canadensis*).
Douglas fir (*Pseudotsuga mucronata.*)
White or silver fir (*Abies concolor*).
Chinese arbor vitæ (*Thuja orientalis*).
Dwarf juniper (*Juniperus communis*).
Red cedar (*Juniperus virginiana*).

Broadleaved species suitable for street and yard planting:

Silver maple (*Acer saccharinum*).
Red oak (*Quercus rubra*).
Pin oak (*Quercus palustris*).
Burr oak (*Quercus macrocarpa*).
Hackberry (*Celtis occidentalis*).
White elm (*Ulmus americana*).
Rock or cork elm (*Ulmus thomasi*).
English elm (*Ulmus campestris*).
Tulip tree (*Liriodendron tulipifera*).
Sycamore or plane tree (*Platinus occidentalis*).
Black cherry (*Prunus serotina*).
Kentucky coffee tree (*Gymnocladus dioicus*).
Thornless honey locust (*Gleditsia triacanthos*).
Green ash (*Fraxinus lanceolata*).
Russian wild olive (*Eleagnus angustofolia*).
Pecan (*Hicoria pecan*).
Basswood (*Tilia americana*).
Carolina poplar (*Populus deltoides var. caroliniana*).
Norway poplar (*Populus deltoides* var.).
Tree of heaven (*Ailanthus gladulosa*).
Red bud (*Cercis canadensis*).
Wild crab (*Malus cornaria*).
Smooth sumach (*Rhus glabra*).
Sumach (*Rhus copallina*).
Red haw (*Cratægus mollis*).
Cockspur (*Cratægus crus-galli*).

Trees suitable for wood-lot planting:

Austrian pine (*Pinus austrica*).
Red cedar (*Juniperus virginiana*).
Chinese arbor vitæ (*Thuja orientalis*).

Cottonwood (*Populus deltoides*).
Black walnut (*Juglans nigra*).
Hardy catalpa (*Catalpa speciosa*).
Burr oak (*Quercus macrocarpa*).
Red oak (*Quercus rubra*).
Pecan (*Hicoria pecan*).
Osage orange (*Toxylon pomiferum*).

TREES FOR THE SECTION IN WHICH THE ANNUAL RAINFALL IS LESS THAN TWENTY-FIVE INCHES.

Evergreens suitable for protective and ornamental planting:

Red cedar (*Juniperus virginiana*).
Dwarf juniper (*Juniperus communis*).
Chinese arbor vitæ (*Thuja orientalis*).
Austrian pine (*Pinus austrica*).
Scotch pine (*Pinus sylvestris*).
Western yellow pine (*Pinus ponderosa*).

Broadleaved species suitable for street and yard planting:

Thornless honey locust (*Gleditsia triacanthos*).
Hackberry (*Celtis occidentalis*).
White elm (*Ulmus americana*).
Green ash (*Fraxinus lanceolata*).
Russian wild olive (*Elæagnus angustifolia*).
Osage orange (*Toxylon pomiferum*).
Russian mulberry (non-fruiting only) (*Morus alba*).

Species suitable for wood-lot planting:

Austrian pine (*Pinus austrica*).
Red cedar (*Juniperus virginiana*).
Chinese arbor vitæ (*Thuja orientalis*).
Cottonwood (*Populus deltoides*).
Osage orange (*Toxylon pomiferum*).
Kentucky coffee tree (*Gymnocladus dioicus*).
Black walnut (*Juglans nigra*).
Russian mulberry (*Morus alba*).

The selection of trees for any definite locality in this region must be determined by the character of soil in which they are to be planted. The following are well adapted for heavy loam upland soil:

Red cedar.
Scotch pine.
Austrian pine.
Western yellow pine.
Chinese arbor vitæ.
White elm.

Hackberry.
Honey locust.
Osage orange.
Russian wild olive.
Green ash.

For planting on loam soil in valley lands along the water-courses or in ravines, the cottonwood, black walnut, and Kentucky coffee tree may be added to the above list.

For planting in light sandy soil, such as sand dunes or in sandy river valley soil, the following are satisfactory:

Red cedar.
Austrian pine.
Western yellow pine.
Scotch pine.
Jack pine.

In sandy loam soil the cottonwood, osage orange, and Russian mulberry may be added to the above list.

The boxelder, soft maple, Carolina poplar, and others of the more rapidly growing species are omitted from this list because they are at best but short-lived in this section. They reach their development in about fifteen or twenty years, and then die. Whenever these species are planted they should be in a mixture with some of the longer-lived species, such as the white elm, hackberry, honey locust, and Russian wild olive. These trees, while slower in their development, will attain sufficient size to occupy the ground fully and take the place of the shorter-lived trees by the time the latter begin to die.

The State Forestry Nursery.*

Because of the insistent and growing demand from the people of the western part of the state, the department of forestry of the Kansas Agricultural Experiment Station has established a state forest nursery at the Fort Hays Branch Experiment Station, Hays, Kan.

The purpose of this nursery is to supply stock suitable for planting in western Kansas. When the trees produced here reach sufficient size they are sold to the actual planters at cost of production. The price of this stock varies with the species, age, grade, and season.

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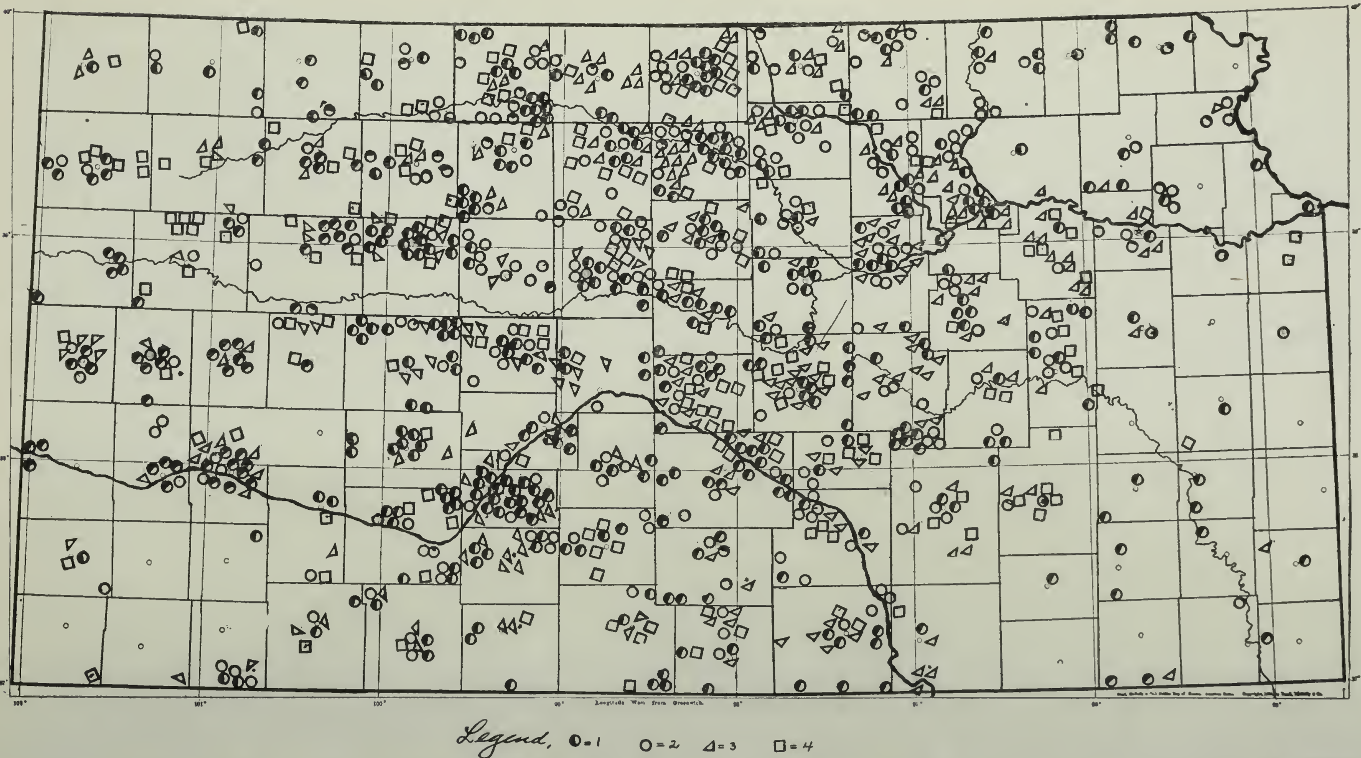
* The state forest nursery is under immediate supervision of J. W. Preston. Much of the success of the undertaking is due to his skillful and efficient work.



The above map of Kansas shows the distribution of trees sent out from the state nursery during the years 1912, 1913, 1914, and 1915, as indicated by the several characters:

1 shows the points to which shipments were made in 1912.
2 shows the points to which shipments were made in 1913.
3 shows the points to which shipments were made in 1914.
4 shows the points to which shipments were made in 1915.

This chart, furthermore, shows the sections of the state in which tree planting is a factor in farm and home development.

GROWING NURSERY STOCK.

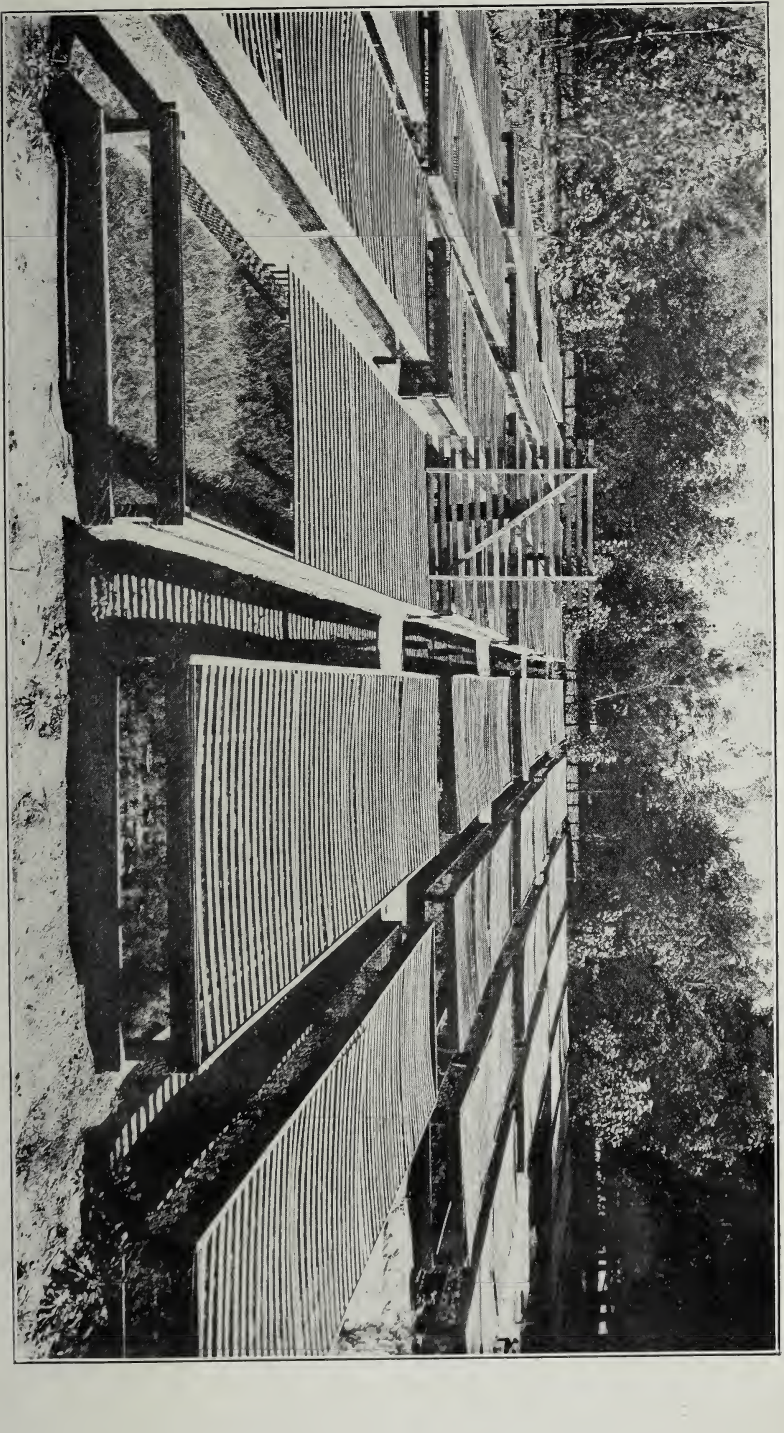
The growing of evergreen stock requires the attention of a skilled and experienced nurseryman. The seed may be sowed either in the fall or spring in well-prepared beds enclosed with a frame of boards and wire netting and covered with a lattice roof. The enclosure is to protect the seeds and seedlings from birds and animals, while the lattice roof shields them from the sun, wind, rain, and hail. Most of the evergreen seedlings, that survive under natural conditions, grow in partial shade. Very few of them can endure the full sunlight during the first summer. During their first season the seedlings are subject to several plant diseases, and it is this period that tests a nurseryman's skill in saving his stock.

At one or two years of age they are transplanted to nursery rows, where they are grown from one to three years, or until of suitable size to plant in their permanent location.

The seeds of the broadleaved species are usually sown in the open field in nursery rows, where the stock grows without being transplanted, until of sufficient size for permanent planting; but it is usually root pruned at one or two years of age. The broadleaved seedlings are less liable to plant diseases than the evergreen seedlings, and they grow with much more vigor, attaining heights varying from one to three feet in a single season. At one, two and three years of age this stock is of suitable size for wood-lot and windbreak planting.

PLANTING TREES.

The successful result of any planting depends on three factors: (1) the freshness and vigor of the trees; (2) the proper planting in a congenial soil; (3) the conservation of moisture by cultivation and the protection from injury by live stock and insects. The difficulty that many tree planters have experienced in growing evergreen trees is due to the dead or dying condition in which the stock was received. Evergreen trees are very sensitive and a few minutes' exposure of their roots to the air is fatal. All danger of such injury is easily prevented if the roots are puddled as soon as the trees are dug in the nursery and again when they are unpacked to be planted.



A block of evergreen seedling beds in the state forest nursery. Note construction of the seedbed frames and latice covering to protect the plants from wind, sun, rain and hail.

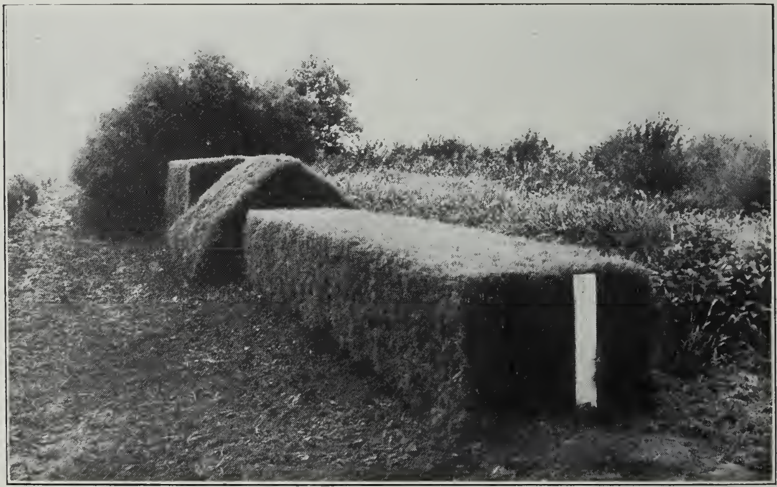
Two-year-old transplanted red cedars in the nursery row in the state forest nursery.

A block of catalpa seedlings in the state forest nursery, Hays, Kan.

A block of 15,000 transplanted four- to eight-foot white elm trees in the state forest nursery.

A block of 20,000 three-year-old five- to nine-foot honey locust trees in the state forest nursery.

A block of 50,000 three-year-old four- to nine-foot green ash trees in the state forest nursery.



A tamarix hedge growing at the Fort Hays Branch Experiment Station, Hays, Kan. This hedge was grown without irrigation. It was sheared about once every two weeks throughout the summer to keep it in good form. The different forms show how the hedge may be developed. The clump at the further end shows the unsheared natural development. The tamarix is entirely hardy in western Kansas and it is well adapted for hedges and ornamental planting.

CARE OF PLANTING STOCK.

The care of the planting stock is of prime importance. The trees should be handled at all times with the greatest care, with full knowledge that they are perishable and that any exposure of the roots is injurious to their future growth. After the trees are received, they should be kept in a cool, shaded place or be heeled in. If they are to be set within a day or two, they will usually keep in perfect condition in the shipping bundle, if properly protected. A cellar is an ideal place in which to store them for a few days. When this is not available, they can be buried in an old straw pile. If several days are likely to elapse before planting, it is advisable to unpack them, heel them in, and tramp fresh soil firmly about the roots, after which the tops may be covered with hay or straw for protection against the sun and wind. If the trees are properly heeled in, they will keep for a week or longer without injury. It is seldom, however, that they need to be kept for this length of time before a favorable planting day occurs. Actual planting should be done only during favorable weather. It is impossible to protect a tree against exposure during periods of dry, windy weather. A cloudy or damp day is the best time for planting trees. The trees can then be handled without endangering the roots, and the soil can be exposed without serious drying.

PREPARATION OF GROUND FOR PLANTING.

The preparation of the ground for tree planting is, next to the selection of the species for planting, the most important step in successful tree growing. Trees can not grow unless there is sufficient moisture in the soil to keep them in a thrifty condition. A tree, when transplanted, is set in the ground with less than twenty-five per cent of its former root system; consequently the first thing a newly planted tree must do is to develop a new system of roots and establish itself in its location. To do this, and at the same time to support a growth of leaves, requires a liberal supply of moisture. The only way to supply this moisture is to have it in the soil when the trees are planted.

Virgin prairie soil is unsuited for trees. The ground should be broken and cropped at least one year before planting. If cropping is not practical, the ground should be broken, thoroughly disked, and plowed to a depth of eight or ten inches, and summer fallowed one season.

Ground that has been under cultivation for some time should be fallowed for a year before the trees are planted. This includes deep plowing in May or early June, followed by sufficient surface cultivation throughout the summer to keep down all weeds and to maintain a soil mulch. Deep plowing loosens the soil and puts it in condition to retain all the moisture that falls upon it. The surface tillage during the summer not only controls the weeds but also prevents the loss of moisture from the soil by evaporation. This is particularly important in western Kansas.

For street and yard planting, deep plowing and summer fallowing can not be practiced. Instead of deep plowing, deep spading may be substituted. Street and yard trees, with the most favorable treatment, are under a serious handicap. The grass sod or other native vegetation growing around them uses a large proportion of the soil moisture which is needed by the trees. The immediate location for such trees should be spaded up for an area at least six feet in diameter. The depth to which the ground should be loosened will depend entirely upon the character of the subsoil. If the subsoil is hard "jointed clay," it will be advisable to loosen the ground to a depth of three or four feet. In case the subsoil is loamy, spading to a depth of eighteen or twenty inches will be sufficient. When a supply of water is available, the ground for such planting need not be spaded up until within a few days of the time the trees are to be set. Immediately after being spaded up, the ground should be thoroughly wet and allowed to remain undisturbed for two or three days before the trees are planted.

The practice of digging the holes some weeks or months before the trees are to be planted is a serious mistake. Such a practice permits the exposed soil to become air dry, and if the subsoil contains clay, to bake and harden. Such a condition is difficult to correct. Tree holes should be dug only when the trees are ready to set. The moist soil taken out of the hole is then in good condition to fill in about the roots and will reunite readily with the bottom and sides of the hole. This can not occur when the hole is left open for some time before the tree is planted.

TIME TO PLANT.

Most successful results are secured from early spring planting. The latter part of March or early April is the proper time to plant either evergreen or broadleaved species. Early planting allows the roots to begin growth by the time the leaves are bursting and to supply proper moisture for the tree. Late spring planting is objectionable because the leaves come out before the new roots develop and the tree is likely to die and certain to suffer greatly from the lack of moisture. For the same reason it is unsafe to plant trees in the fall where the autumn and winter seasons are dry. Trees set in the fall do not develop feeding roots until the following spring, and during the winter months there is great danger of the stems and branches becoming thoroughly dry by transpiration through the pores in the bark.

METHOD OF PLANTING.

In planting trees, the holes should be dug fully twice as wide and twice as deep as the roots require in their natural position. By this method the soil is thoroughly worked over and pulverized, and is capable of absorbing and retaining a greater amount of moisture than would otherwise be possible. Loosening and aërating the soil liberates the plant food and induces a vigorous growth. The tree should be set in place at about the same depth that it grew in the nursery, and the roots should be spread naturally, covered with three or four inches of soil, and tramped firmly. The object of firming the soil is to bring the roots and soil in close contact. After this the hole should be filled with loose soil to the level of the surrounding ground. The surface should be left in a loose condition for a mulch.

CULTIVATION.

After the trees are planted, they demand as careful cultivation as any crop. This fact is too often overlooked in the care of trees. It is unreasonable to expect newly planted trees to compete successfully with the native plants of the region. Cultivation conserves the soil moisture by preventing evaporation and keeps down other vegetation which would use the moisture needed by the trees. The cultivation need not be deep, but must be thorough. The more intensive the cultivation, the greater the success will be.

PROTECTION.

Newly planted trees require protection against injury by the sun, wind, and animals. Protection against injury by the sun and wind is required by the evergreens more than by the broadleaved species. Furthermore, because evergreens are in full foliage when they are planted, there is considerable danger that they will suffer from the effect of excessive transpiration. To guard against this danger, a screen of some kind should surround them. When only a few trees are involved, small boxes with their tops and bottoms knocked out, can be set around the trees. Empty nail kegs will also answer the purpose. A screen of burlap tacked to three or four stakes at equal distances around the tree answers the purpose very well. For extensive planting, as in groves and shelter-belts, shingles or short pieces of light box boards from six to eight inches in width, driven into the ground a few inches from the tree on the southwest side, provide excellent protection. Some protection of this nature is very necessary during the first month or six weeks after the evergreens are planted.

The broadleaved species will require no special protection, except from rabbits. Their stems should be wrapped with burlap, grass, cornstalks, or wooden veneer tree-protectors, or painted with crude oil.

Live stock of all kinds must be rigidly excluded from the area occupied by young trees. Browsing off the tips of the branches, rubbing against the stems, and trampling the ground around the trees, are all detrimental and can not be permitted if successful growth is to be secured.

When leaf-eating insects threaten, the trees should be sprayed with an arsenical spray. To protect against borers, the stems of the newly planted trees may be painted with a saturated solution of sal soda, to which enough laundry soap has been added to make a thick paint. Carbolic acid is then added to this mixture at the rate of one pint to ten gallons. This should be applied frequently enough to keep the stems completely coated from the first of May to the middle of August during the first and second seasons.

RESULTS.

The results secured from trees sent out by the state nursery during the past four years have been very satisfactory, as shown in the following tables, compiled from reports sent in by those who planted state nursery stock. It may be mentioned that the seasons of 1912, 1913 and 1914 were very unfavorable for planting trees.

TABLE I.—Showing result of planting in 1912.

Species.	Total number sold.	Total number reported.	Total number reported living.	Percent living trees reported.
Red Cedar	37,107	22,800	15,518	68
Catalpa	18,712	11,445	10,319	90
Green Ash	3,700	1,723	1,295	90
White Elm	4,952	2,191	1,912	87
Honey Locust	2,611	1,125	854	76
Total	67,082	39,284	29,898	76

TABLE II.—Showing result of planting in 1913.

Species.	Total number sold.	Total number reported.	Total number reported living.	Percent living trees reported.
Catalpa	68,210	64,401	47,835	74
Chinese Arbor Vitæ	26,010	10,739	6,552	61
Red Cedar	4,746	2,248	1,327	59
Russian Wild Olive	262	168	75	45
Honey Locust	11,497	6,303	4,570	73
Osage Orange	30,570	13,220	3,244	24
White Elm	1,917	1,160	738	64
Green Ash	650	332	258	75
Poplar	156	156	129	83
Mulberry	200	200	200	100
Total	144,218	98,927	64,928	65

TABLE III.—Showing result of planting in 1914.

Species.	Total number sold.	Total number reported.	Total number reported living.	Percent living trees reported.
Catalpa	35,100	32,500	30,809	95
Chinese Arbor Vitæ	36,543	17,571	11,228	63
White Elm	2,318	1,060	828	78
Green Ash	496	292	212	72
Honey Locust	1,495	580	393	67
Total	75,952	52,183	43,470	83

TABLE IV.—Showing result of planting in 1915.

Species.	Total number sold.	Total number reported.	Total number reported living.	Percent living trees reported.
Catalpa	5,497	5,201	5,199	99
Chinese Arbor Vitæ	14,150	8,035	7,310	91
White Elm	3,415	2,747	2,637	96
Green Ash	458	77	74	96
Honey Locust	8,249	4,598	4,272	93
Osage Orange	14,703	7,206	5,959	83
Russian Mulberry	406	159	158	99
Russian Wild Olive	355	88	83	93
Tamarix	484	473	458	97
Poplar	259	106	102	96
Cottonwood	2,875	400	260	65
Hackberry	697	110	108	98
Kentucky Coffee Tree	27	13	13	100
Red Bud	320	237	232	98
Total	51,895	29,450	26,845	91

SUMMARY.

Successful results in planting trees depend upon:

(1) The trees.
(2) Their proper protection.
(3) Thorough cultivation.

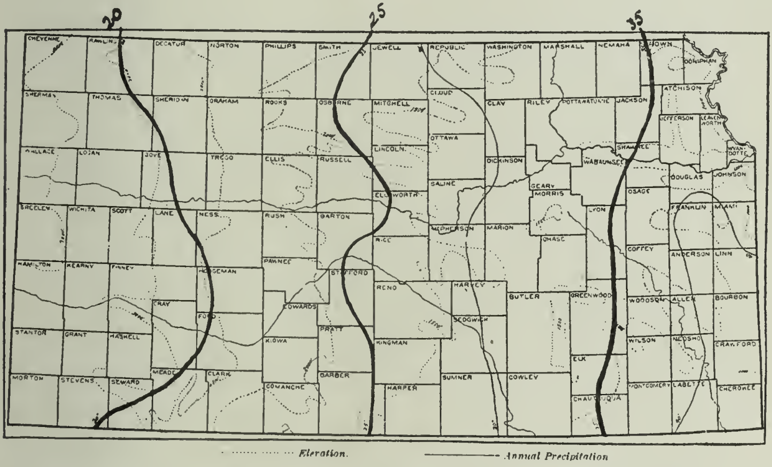
The trees must be fresh and vigorous, as well as carefully selected with regard to the soil and climate of the locality in which they are to be grown. Only transplanted evergreen stock that is from fifteen to eighteen inches in height should be used for permanent planting. Larger-sized evergreens for ornamental planting can be handled successfully only when balls of earth are bound securely about the roots. Broad-leaved trees desired for street and yard planting should be from eight to twelve feet in height, and from one and one-fourth to two inches in diameter, though stock ranging from four to six feet in height is better for extensive planting.

The protection of planting stock is of prime importance because it is highly perishable, and suffers greatly from exposure or drying. Planting should not be attempted during a dry, windy period, and newly planted evergreens should always be protected from the sun and wind. All young trees must be protected against insects, rabbits, and live stock. Early spring planting is preferable to fall or late spring planting.

Thorough preparation of the planting site is essential to good results. The soil should be very firmly tramped about the roots of the newly set trees and thoroughly cultivated until the trees are well established.

Many evergreens are among the hardiest trees for Kansas, because they are comparatively free from insect attacks, are long lived, and suffer less from hail and wind storms than broadleaved species. There is no locality in Kansas where at least one of the evergreens will not grow. These trees are very valuable as windbreaks, for wood lots, and for ornamental planting and hedges.

Trees, like other plants, vary in their soil and climatic requirements. Most trees require a deep, rich, moist, well-drained soil and a humid atmosphere during the summer months. Moisture is more important than temperature, although some trees, like the herbaceous desert plants, thrive in arid climates. Trees of this last type should be selected for planting in western Kansas.



Outline map of Kansas showing the limits of the average annual rainfall. The eastern section has a rainfall of thirty-five inches or more. In the central section it varies from twenty-five to thirty-five inches, while in the western section it is less than twenty-five inches.

For price lists of planting stock and for information of any nature concerning trees not given in this circular, address, The State Forester, Manhattan, Kan.

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